

INTERNATIONAL SCIENCE NEWS & INSA DELEGATION REPORTS

Volume 4

Number 4

October 1986

INDIAN NATIONAL
SCIENCE ACADEMY
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002



International
Science News &
INSA Delegation
Reports

Editors of Publications : Professor A N Mitra, FNA
: Dr G S Venkataraman, FNA

Associate Editor : Dr M Dhara

Edited and Compiled by
Scientific Officer (I & L) : Dr Alok K Moitra

© Indian National Science Academy, New Delhi.

EDITOR'S NOTE

INSA is committed to the growth of natural knowledge in India and its application to the problems of national welfare. Being the adhering body in India for the ICSU, the Academy is entrusted with deputing Indian delegations to various international conferences and symposia. Since its inception in 1935, INSA has endeavoured to promote the dissemination of scientific knowledge and matters concerning science policy and philosophy of science. The Fellows of the Academy have played a major role not only in practising science but in actively participating in professional meetings the world over.

Realizing that the three scientific journals being published by the Academy are primarily devoted to the communication of scientific research findings, a new quarterly journal has been started to cover international science news and present delegation reports to the Fellowship and to the Indian scientific community at large. The contents of the journal cover: (i) reports of General Assembly meetings of ICSU and other organizations; (ii) reports of INSA delegations sent abroad; (iii) brief accounts of individual scientists sponsored by INSA to attend conferences; (iv) highlights of international conferences in specialized areas of research; (v) experiences of scientists under Inter-Academy exchange programme; (vi) summaries of lectures delivered by distinguished scientists and (vii) excerpts of newsworthy items from leading international scientific journals.

Through this publication, the Academy aims to spread current developments in scientific knowledge and to ascertain view on values and judgements in science and technology.

It has been three years now since the idea of publishing the delegation reports was first conceived. We have been receiving objective reports of the delegates sponsored to various international conferences and symposia. Apart from reporting to the Academy about their individual contributions to a given conference, the delegates are expected to focus attention on its main theme as well as highlight the major conclusions for the benefit of the wider community. This will provide an overall picture of the conference to the interested reader and thus help in meeting the basic obligations of the journal.

The number of write-ups received by us in last three years were much more than could possibly have been included in this journal. In order to cover the maximum number of conferences/symposia, some of these reports are being included as short communications, and more such items are envisaged in the forthcoming issues. We also look forward to suggestions for improving the contents and scope of this journal.

A N Mitra

INTERNATIONAL SYMPOSIUM ON GRASS SYSTEMATICS AND EVOLUTION : A REPORT*

Dr S K Jain participated in the International Symposium on Grass Systematics and Evolution held at the Smithsonian Institution, Washington DC, USA from July 27-31, 1986. It was sponsored jointly by the Smithsonian Institution, American Institute of Biological Sciences and National Science foundation. About 150 scientists from various parts of the world attended the conference; this included five botanists from India, namely Professor H Y Mohan Ram and Dr Hari Gopal of Delhi University, Dr M L Sharma of Punjab University, Chandigarh, Dr Ved Prakash of Central Drug Research Institute, and Dr S K Jain of National Botanical Research Institute, Lucknow.

The inaugural keynote address was delivered by noted agrostologist Dr RW Pohl, who spoke on economic aspects of grasses.

The technical programme was divided into six sessions : one each on structural diversity, reproductive biology, biochemical diversity, evolution and two on systematics of major groups. Thirty-two papers and 37 poster presentations were listed; almost all were presented.

Professor Melvin Calvin gave a symposium address on *Liquid Fuels and Feed-Stocks from Plants*. The symposium ended with a concluding address by Professor G L Stebbins Jr on *Processes and Trends of Evolution in the Poaceae*. Two field trips to Chesapeake Bay and Shenandoah Park were organised after the symposium. Dr S K Jain chaired a session on systematics of major groups.

The presentations in the symposium covered topics like paleoagrostology; origin of grasses, vegetative morphology, leaf blade anatomy, morphology and functions of spikelets, and fruits and embryos, reproductive biology like dispersal, gametophyte—sporophyte relationships, and pollen-stigma interaction, chromosomal evolution hybridisation and polyploidy, photosynthetic pathways, significance of chloroplast DNA, amino acids, flavanoids, isozymes and rust fungi in systematics, biogeography, endemism, domestication, classification, phylogeny, taxonomic concepts, numerical taxonomy, and chorology.

*Based on the delegation report of Dr S K Jain, Pitamber Pant National Environmental Fellow, National Botanical Research Institute, Lucknow, U P.

A few presentations related to specific groups like bamboos, Arundinoids and Chloridoids. An interesting demonstration was given on computer-generated descriptions of genera.

Following are some of the significant observations made during the symposium :

The grasses and the domestic animals coevolved on this earth. Classifications of grasses into 5-7 subfamilies, rather than Bentham and Hooker's two subfamilies has received more support from cytological and anatomical data.

Suppressions, multiplication and fusion of parts in the florets and the spikelets has occurred repeatedly during evolution of the Gramineae. Anemochory, epizoochory and endozoochory by birds and mammals, and various kinds of autochory, especially drilling and creeping of diaspores, are the most important dispersal systems in grasses.

The reproductive biology of the grasses encompasses most of the sexual and asexual systems described in other plant families-autogamy, cleistogamy, and apomixis. Distinctive features lie in the two loci independent multiallelic system of gametophytic incompatibility, wide-spread anemophilly, and the absence of sporophytic incompatibility and of heterostyly.

The events prior to fertilisation in the Gramineae are (a) pollen capture and hydration; (b) germination; (c) stigma penetration; (d) entry of the tube into the transmitting tracts of the stigma; (e) passage through the tract and penetration into the ovary cavity; (f) growth between the inner ovary wall and the integuments to the micropyle and (g) penetration through the nucellus and entry into one synergid. Hydration is a critical prelude to pollen germination; it is regulated by the state of the pollen membranes, and by properties of the stigma surface secretions.

Polyploidy and aneuploidy are conspicuous features of chromosomal evolution in the Poaceae. At least 80 per cent of grass species are of polyploid origin. The original basic chromosome numbers in the family probably were $x = 5, 6$ and 7 . Polyploidy is often associated with gametophytic apomixis, but numerous polyploids reproduce strictly by sexual means. Hybridization plays a major role in the success of polyploids.

The C_4 dicarboxylic acid pathway of photosynthesis, first discovered in sugarcane and maize, characterises about half of the Poaceae (Chloridoideae, Andropogonanae, Panicanae in part, and a few Arundinoideae). Other species are C_3 (Pooideae, Bambusoideae, Panicanae in part, and nearly all Arundinoideae), with some exceptions.

The chloroplast DNA is an ideal tool in systematic and evolutionary studies. Chloroplast DNA is a slowly evolving genome with a very low incidence of parallel and convergent evolution. It is also a convenient genome to use since it is relatively small in size, lacks molecular heterogeneity, and can be extracted in adequate quantities even from a single plant.

Much knowledge has been accumulated over recent years with regard to the taxonomic value of protein amino acid profiles in plants. In all these studies, the Pooideae proved distinguishable as a group from the Panicoideae and the close taxonomic affinity between the Panicanae and Andropogonanae was re-affirmed. In terms of these analyses, the Chloridoideae and Arundinoideae have appeared somewhat intermediate between the Pooideae and Panicoideae, whereas the Bambusoideae tended to show closer similarity with the Pooideae than with the Panicoideae. The close taxonomic affinity between the two supertribes, Oryzanae and Bambusanae, was evident.

The apparent simplicity in the flavonoid aglycones found in the grasses masks the considerable complexity in the way these compounds are conjugated in the plants. Glycoflavones of rice act as probing stimulants to plant hoppers, while those of pasture grasses are sequestered and stored by certain satyrid butterflies. Tannis are uncommon in the grasses, but when they do occur, as in Sorghum, they can have toxic effects on mammalian herbivores.

Although more than 24 grass genera have been assayed electrophoretically, isozyme variability has been studied extensively in only six genera : *Triticum*, *Hordeum*, *Zea*, *Secale*, *Avena*, and *Oryza*.

The most unequivocal evidence concerning the evolution of the grasses are their fossil remains. Exclusive of pollen, such fossils are known from Eocene through Pleistocene strata in western and central North America, eastern Europe, and north-eastern and east Africa, and possibly from several stratigraphic levels in Asia and South and Central America. Future needs in paleoagrostology include more exhaustive investigations of known and probable fossil grass-bearing localities, micromorphological studies of fossils identified solely on macromorphological bases, studies centered on determining the reliability of palynological evidence of fossil grasses in ancient strata.

During a study of biogeography of grasses, ca 9500 species from throughout the world were scored for presence or absence in ca 209 \pm equal-sized provinces or states which, as far as was practicable, had a comparable range of habitats. Species which were chorologically similar were identified and mapped. The results are arranged in a hierarchy of Kingdoms, Regions, and Domains.

Differences between Old and New World agricultural cradles reflect differences in the species available for domestication, and in their evolutionary pathways and adaptations to biometrically opposed climatic cycles at disparate latitudes.

Comparative morphology, rust relationships and plate tectonic data show Bambusoideae to be ancient, spreading from Africa to South America and from Madagascar to the Indian Craton in Upper Cretaceous time, followed by radiations in South America and Southeast Asia. The most advanced rusts of Bambusoideae grade into the most primitive ones of Arundinoideae and Andropogonoideae reflecting morphological links between these grasses. Graduations in rust morphology indicate Bambusoideae to be the oldest grass group, followed by Arundinoideae and Andropogonoideae, then Panicoideae, Chloridoideae and Pooideae. Rust data support placement of Olyreae in Panicoideae. Oryzoideae seem far from Bambusoideae and isolated.

Grasses have long been allied with the superficially similar Cyperaceae, but the accumulated evidence does not support phylogenetic affinity of the two groups.

The Gramineae share possible synapomorphies with Centrolepidaceae (floral reductions and spikelets), Joinvilleaceae (alternating long and short cells and microhairs in the leaf epidermis), and Restionaceae (spikelets and microhairs).

Several lines of evolution can be traced within the Bambuseae itself, each of which is defined as one of the following subtribes; Arthrostylidiinae, Arundinariinae, Bambusinae, Chusqueinae, Guaduinae, Nastinae, Neurolepidinae, Phyllostachydinae, and Schizostachydinae. The new arrangement of genera indicates that similar evolutionary pathways have occurred in different subtribes and represent parallel evolution, for example : development of the common grass spikelet from a pseudo-spikelet, of a fleshy fruit from dry caryopsis, and of the monopodial from sympodial type of rhizome.

The subfamily Arundinoideae is composed of genera and tribes, whose similarity is not based on their relation to one another, but on the inability to place them to other Gramineae subfamilies.

The Stipeae has major centers of diversity in Eurasia, South America (Approx. 150 species each), Australia and North America (Approx. 60 species each).

Aspects of pooid classification requiring further research include the subdivision of the larger tribes, the relationship of the Meliceae to other Poanae, and the uniformity of generic concepts.

The chloridoid grasses are defined by a characteristic bicellular microhair (the only exclusive character) plus either the PCK or NAD-me C_4 carboxylation pathway

and the associate ultrastructure; further studies may add some exclusive embryo characters. About 15 characters occur commonly through the subfamily and several of these are regarded as primitive in the grasses.

Andropogoneae is a well defined tribe whose probable origin may be traced back through Arundinelleae to Arundineae. Its most characteristic feature is the occurrence of the spikelets in pairs, one sessile, the other pedicelled.

The grasses are still far from being understood phylogenetically and consequently classifications remain unsatisfactory. Tribal classification is especially unsatisfactory. The task that lies ahead using numerical techniques is enormous in view of the small number of taxa investigated (e.g., 25 out of *ca* 700 genera).

The Bambusoideae (including Oryzeae but excluding Centothecae) Panicoideae and possibly the C_4 grasses were monophyletic, and that Arundinoideae were polyphyletic. Subsequent work has shown that the Oryzoids are the sister group of the bambusoids, that the Pooideae s.l. are monophyletic, with the Stipeae as a basal mono- or paraphyletic group, and *Brachyelytrum*, *Diarrhena* and *Phaenosperma* appear near the base of the pooid clade. The Chloridoideae and Panicoideae are derived from within a largely unstructured group of Arundinoideae; the lack of structure reflects continuing problems with lack of anatomical data.

China has long been known as a kingdom of bamboos. China is not only rich in species (about 30 genera and 370 species) but also abundant with endemic genera and species, covering approximately 2/3 of all total taxa in China.

Taxonomic descriptions of members of Bambusoideae lack information on the mode of spikelet proliferation and nature of spikelet apex. There are reports that the spikelet apex shows either unisexual or rudimentary florets.

A study provided material for tracing evolution of single-flowered spikelet of grasses from the multi-flowered spikelets of bamboos or vice versa.

Poaceae is cosmopolitan in distribution; but several species and even genera are endemic to small regions. About 1250 species of grasses belonging to over 300 genera occur in India. The region is rich in endemism and also diversity in several genera. Over 325 taxa of Poaceae are endemic in India.

Peninsular India could well be the centre of origin for *Glyphochloa*, *Dimeria* and *Arthraxon* and a secondary centre for genera like *Isachne* and *Ischaemum*.

The tribe Isachneae is apparently a natural assemblage of five genera, viz. *Isachne*, *Coelachne*, *Limnopoa*, *Heteranthoecia* and *Sphaerocaryum* (after Hubbard).

The tribe Isachneae is panicoid in most characters, yet it stands apart from true panicoid grasses in some unique morphological and anatomical characters. Consequently, Isachneae should be placed either in Panicoideae near Paniceae, or it should better be treated as an independent subfamily.

The grasses (Gramineae) evolved along four lines helped by evolution in vegetative characters, leaf anatomy and photosynthetic pathways, flowers, dispersal mechanisms and evolution in chromosome numbers and size.

II INDO-SOVIET CONFERENCE ON LOW TEMPERATURE PHYSICS : A REPORT

In the field of low temperature physics, Soviet scientists like Kapitsa, Landau and others have been the world leaders and the topic has been naturally chosen as one of the main fields for the cooperation between the Indian and Soviet Academies. After several exchange visits by scientists from both sides, the first Indo-Soviet conference on low temperature physics was held in Bangalore during January 1984, as a part of the Golden Jubilee of the Department of Physics, Indian Institute of Science. The Institute of Physical problems of the USSR Academy was started in 1936 by Academician Kapitsa and the second binational conference was held in Moscow during the period May 15-23, 1986. Ten scientists attended the conference from India. Professor S Ramaseshan who was to be the leader of the delegation, had to cancel the visit unexpectedly and Professor E S Raja Gopal, who was coordinating the program, acted as the leader of the delegation. Academician A S Borovik-Romanov, the Director of the Institute for Physical problems, was the organizer of the conference from the Soviet side.

The scientific program of the conference consisted of 13 reports from the Indian scientists and restricted to 18 reports from the Soviet colleagues. Experimental techniques at ultra low temperatures and combined low temperature high pressure experimentation, investigations of magnetism and magnetic materials, liquid helium of isotopes 4 and 3, superconductivity, electrical and mechanical properties of disordered systems and the new interest in the Quantum-Hall effect were the focii of the various sessions. The interplay between new theoretical ideas and the progress in new experimental techniques was clearly evident. The rapid advances made in these areas by the research groups in India were also evident. The extensive discussions at the end of or during each paper and the consequent extension of the session time could be taken as one measure of the utility and value of a conference.

Superconductivity, because of its basic interest and technical applications, continues to be an active field of study. Professor N E Alekseevskii discussed the recent work on heavy Fermion superconductivity. Professor L P Gorkov talked about other unusual possibilities for superconductivity. Professor K P Sinha (IISc,

* Based on the delegation report of Professor E S Raja Gopal, FNA, Department of Physics, Indian Institute of Science, Bangalore.

Bangalore) presented some new theoretical results on the coexistence of magnetic ordering and superconductivity. Dr A V Narlikar (NPL, Delhi), summarized the evidence for the role of antiferromagnetic type interactions in the mechanism of superconductivity. Dr Narlikar also presented some recent work done at NPL on the transformation kinetics during the preparation of superconducting materials and on the realisation of the voltage standard using Josephson junctions. Niobium-titanium superconducting alloys, which are widely used to generate high magnetic fields, were discussed by Dr T S Radhakrishnan (IGCAR, Kalpakkam). The role of structural disorder in the performance of high field superconductors was studied by Dr P Chaddah (BARC, Bombay). Professor G Rangarajan, (IIT., Madras) presented some new results on the penetration of magnetic field into superconductors. The USSR work of N V Zavaritsky and others covered many interesting aspects of superconductivity, phenomena as well as materials.

Magnetism has been traditionally connected with low temperature quantum effects. Professor R Vijayaraghavan (TIFR, Bombay) presented some new results on rare earth systems, while Professor S K Dutta Roy (IIT, Kharagpur) summarised the phase transformation in some paramagnetic crystals at low temperatures. The soviet work of Professor Borovik-Ramanov, Dr A Z Bazhan and others from the Institute of Physical Problems covered nuclear demagnetisation techniques, spin wave phenomena, spin glasses and aspects of magnetic ordering. There was no work presented from the Indian side on the study of liquid helium, another traditional low temperature activity. The Soviet work of Professor R P Pitaevskii and others covered new interesting observations of superfluid ^3He superfluid ^4He and single crystals of helium. In a similar way there was no paper from the Indian side on Quantum Hall effect, while the strong Soviet research was evident.

The unusual effects of disorder on the physical properties which manifest themselves often at low temperatures, has been attracting much attention in recent times. Professor N Kumar (IISc, Bangalore) gave an interesting talk on some recent work on the fluctuation in residual resistance and the quantum Ohm's law. The low temperature elastic behaviour of metallic glasses (Dr A K Raychaudhuri, IISc, Bangalore) and of semiconducting glasses (Professor E S R Gopal, IISc Bangalore) were discussed. The fluctuations induced in metallic systems due to static and dynamic disorder were discussed by the Soviet scientists like Professor Yu V Sharvin, Dr B L Altshuter, Dr V F Gautmaker and others. There was an interesting paper from the workers in the Moscow State University on the excitation of ultrasonic waves in solids by electrodynamic methods. Another paper devoted to experimental techniques, of high pressure studies at low temperatures, was by Professor S Ramaseshan (R R I, Bangalore).

In the first Indo-Soviet Conference, five scientists from USSR participated. About 100 scientists from all over India took part in the meeting, giving invited talks or

presenting poster papers. In the present conference, ten scientists from India participated. The Soviet participation was largely restricted to about 25 present or past members of the Institute for Physical Problems. The smaller number favoured more intensive discussions. However, it prevented the Indian group from knowing the work being done in other centres.

Academician P L Kapitsa, Nobel Laureate, had taken a keen interest in the cooperation between the two academies in the field of low temperature physics. After his death two years ago, a small memorial is being organized in the Institute by collecting his articles, the historic equipment, photographs, letters and other documents. The Indian delegation visited this memorial and met Mrs. Kapitsa. It is a fitting tribute that the scientific tradition of the late Academician is being continued by the growing cooperation between the two countries.

In the concluding session, it was decided that the proceedings of the conference should be published in English in one of the journals published by the Indian Academy not only as a record of the progress but also to benefit a wider audience. The need for extended visits of 6-12 months duration by the scientists for collaborative research was stressed. There was also a unanimous opinion that the third conference should be held in India after about 2 years.

Indo-Soviet Conference on Low Temperature Physics

(Moscow, 15-25 May, 1986)

Soviet Organizing Committee

1. A S Borovik-Romanov, Academician, Director, Institute for Physical Problems, (Chairman).
2. M S Khaikin, Vice Chairman, Doctor of Science.
3. A N Bazhan, Vice Chairman, Ph D.
4. N E Alekseevskii, Corresponding member of the Soviet Academy of Science, Professor.
5. L P Pitaevskii, Corresponding member of the Soviet Academy of Science, Professor.
6. A I Smirnov — Ph D.
7. A A Karataev — Scientific Secretary.
8. E A Vishnyakova — Secretary.

List of Indian Delegates

1. Professor E S Raja Gopal, FNA, (Leader)
Department of Physics, Indian Institute of Science, Bangalore 560 012.

2. Dr P Chaddah
Nuclear Physics Division, Bhabha Atomic Research Centre, Bombay 400 085.
3. Professor S K Dutta Roy
Department of Physics, Indian Institute of Technology, Kharagpur (WB).
4. Professor N Kumar
Department of Physics, Indian Institute of Science, Bangalore 560 012.
5. Dr A V Narlikar
National Physical Laboratory, New Delhi 110 012.
6. Dr T S Radhakrishnan
Materials Science Laboratory, Indira Gandhi Centre for Atomic Research
Kalpakkam (TN).
7. Professor G Rangarajan
Department of Physics, Indian Institute of Technology, Madras 600 036.
8. Dr A K Raychaudhuri
Department of Physics, Indian Institute of Science, Bangalore 560 012.
9. Professor K P Sinha
FNA, Department of Physics, Indian Institute of Science, Bangalore 560 012.
10. Professor R Vijayaraghavan, FNA,
Tata Institute of Fundamental Research, Bombay 400 005.

IUBS GENERAL ASSEMBLY : A REPORT*

The meeting of the General Assembly of the International Union of Biological Sciences was held at Education and Recreation Centres of Agricultural Cooperatives at Budapest (Hungary) from September 1 to 7, 1985. It was attended by National delegates from 29 countries and 24 scientific members of different commissions. The opening ceremony was addressed by Professor J Sclanki (President, Hungarian National Committee for IUBS), Professor P Fabelle (President, IUBS), Representative of the Hungarian Government and Professor F B Straub (Vice President, Hungarian Academy of Sciences). The last speaker discussed the Unity of Biology.

In the initial plenary session, the reports presented by the Secretary General and the Treasurer indicated the steady increase in the scientific activities of the IUBS, which included subvention to seminars, congresses as well as the scientific meetings at the General Assembly. Country reports were presented by several countries, including India. Ad-hoc committees were formed. The Indian delegation was represented in the Admissions (H Y Mohan Ram) and Statutes (A K Sharma) committees.

The sessions of the different working groups operated simultaneously with the scientific symposia. One of the important aspects of this Assembly had been a proliferation of scientific meetings. This trend had been initiated at the meeting held in Bangalore in 1976. The symposia dealt with (i) Bioindicators; (ii) Decade of the Tropics; (iii) Biological Nomenclature; (iv) Biological Education and (v) Biology and Complexity with Special Reference to Neural Physiology.

During these symposia, the publications brought out wherever possible, by the IUBS and its adhering academies, were displayed, in which the Indian publication *Biological monitoring of the State of Environment* was highly commended. It embodied the proceedings of the symposium on the topic held during the Golden Jubilee Year of the Indian National Science Academy, New Delhi.

All members of the Steering Committee were invited speakers in the symposium on *Bioindicators* held during the General Assembly in Budapest, India was

* Based on the delegation report of Professor A K Sharma, FNA, Programme Co-ordinator, Center of Advanced Studies, (Cell and Chromosome Research), Department of Botany, University of Calcutta.

represented by Professor A K Sharma. This meeting was the inaugural session of a workshop held in Budapest and later at Tihany from September 4 to 11 on *Bioindicators*.

The programme on *Decade of the Tropics* had a considerable impact in different parts of the world. It had focussed on the dwindling resources of the tropics, including the vast germplasm resources, due to indiscriminate exploitation and unplanned development. The need for sustainable development programmes was clearly indicated to be followed by both developed and developing countries. The participation of UNESCO in this programme was highly commended.

The symposium on *Biological Education* emphasized the need for developing attractive and meaningful curricula in biology from the primary level onwards. In this context, the ICSU—CTS conference held at Bangalore in August 1985, sponsored by the Indian National Science Academy, was mentioned. The importance of the use of computers and mass media in Biological Teaching was highlighted in some of the lectures.

The Committee on Nomenclature is still grappling with the problem of a uniform nomenclature system from Prokaryotes to Eukaryotes and any solution appears to be elusive. The Committee on Medicinal Plants has been engaged in the preparation of a Directory of Medicinal Plants, with participation from all countries. All participants at the General Assembly expressed their deep concern at the neglect of taxonomy in different centres of the world and emphasized its strengthening for which different measures were suggested.

The organisers, in addition to receptions and banquets, arranged for visits to different institutes in Biology, which were highly informative and interesting. The Institute of Systematic Botany and Ecology, in addition to maintaining an excellent Botanical Garden, is engaged in the preparation of a Phytogeographical map of Europe.

Two plenary lectures, in addition to the opening one, were delivered on (i) *Protein Synthesizing Structures of Prokaryotic and Eukaryotic Cells* (Acad. A S Spirin, USSR) and (ii) *The Comparative Biology of Neurotransmitter Substances* (Professor D Carpenter, USA).

In the last session, several recommendations were finally adopted. The general recommendations included (i) the responsibility of scientists to work for peaceful use of resources, expressing concern at increasing escalation of the arms race and its huge consumption of resources and (ii) the free circulation of scientists, and their participation at international scientific meetings.

The scientific programmes undertaken by the IUBS, including those on *Decade of Tropics* and *Bioindicators* were strongly recommended for continuation. The

importance of taxonomy as a base for fundamental and utilitarian aspects of biology as well as systems of nomenclature as a fundamental base for communication was stressed. The Peoples' Republic of China was admitted as a new Member of the IUBS General Assembly.

Professor O Solbrig (USA) was elected President for the Executive Meeting upto the next meeting of the Assembly to be held in Australia in 1988.

The Assembly was followed by a meeting of the International Steering Committee on Bioindicators at the Institute of Limnology at Tihany on Lake Balaton on 8 September, in which Professor A K Sharma, as Chairman of the Cell Biology Group, participated. Several decisions were taken in this meeting, including (i) the preparation of manuals on Bioindicators in Plants and Animals and Methods for Bioindication—internal and external (ii) workshops and symposia to be held in 1986 1987 and 1988 and (iii) meeting of the Steering Committee.

Colloque on *Lathyrus* at Pau, France : A Report (September 9-13, 1985)

The Colloque on *Lathyrus* was organised by the Institute de Biocenotique Experimentele des Agrosystems (IBEAS) of the University of Pau (France). The objective of the meeting was to bring together scientists dealing with different aspects of the genus *Lathyrus*—the source of the disease *Lathyrism*, widespread over regions where this legume forms a staple diet. Scientists from all over the world participated, including amongst others, from Bangladesh, Canada, Finland, France, Germany, India, Israel, Nepal, Switzerland, UK and the USA. Altogether 43 invited papers were actually presented, including only two from India (A K Sharma and U C Lavania), in addition to posters and discussion. Despite the fact that several other speakers had been included in the programme from India, where considerable amount of work has been carried out on this problem, particularly in Madhya Pradesh, it is unfortunate that none of them could participate in the conference.

The different sessions included papers on : (i) systematics, cytology and molecular genetics; (ii) genetics and breeding; (iii) plant dynamics; (iv) plant-insect interactions and (v) chemical aspects. It was pointed out that strains of the species *Lathyrus sativus* differed not only in the gross morphological features but in the sequence complexity of the repeated DNA as well. This report added a new dimension to the DNA concept of the genus *Lathyrus* as a whole.

An international database for legumes has been prepared, using computerisation at the University of Southampton, including all legumes of edible value. New ideas were presented on resistance, specificity of plant-insect interrelations and the consequences of DNA change. Considerable discussions were held on the chemical data with special reference to the toxic components responsible for neuro and osteolathy-

atism. The genetic data indicated that the gene for these components may sometimes be linked with white flower colour. If confirmed, this information may open up the possibility of using the latter as a marker in screening populations.

A film was shown on *Lathyrism* in India and Bangladesh. The ban by the Government of India of the cultivation of this crop has led to a nappreciable decrease in the incidence of this disease, by excluding it from the staple diet. However, the growth of this legume under stress conditions in otherwise uncultivable areas and its use as an adulterant, have been factors which have prevented it from being eliminated as a crop altogether by private farmers. Therefore, a more pragmatic and long term approach would be to apply breeding techniques to remove the gene responsible for the toxic components. This method has so far shown promise and needs to be encouraged.

INTERNATIONAL SYMPOSIUM ON FARMING SYSTEMS, RESEARCH AND EXTENSION : A REPORT*

The Farming System Research and Extension (FSR/E) Symposium with the main theme on Management and Methodology was held at the Kansas State University, Manhattan from October 13-16, 1985. The papers presented at this Fifth Annual Symposium show the contributions of FSR/E, the difficulties its implementation in terms of both management and methodology and suggestions often backed up with field experience of how to overcome those difficulties. The cumulative experience from different parts of the world is important for practioners. The papers presented show the tremendous advance in the state of the art in FSR/E in this decade. Research design issues were the other major thrusts in many papers. There is a continuing need for working out the suitable research findings for on-farm research to meet the objectives. The participants included 142 research workers from 34 countries.

Many national programmes are moving from cropping systems to the farming systems approach which is more complex and difficult to implement but are made for increasing productivity. The implementation difficulties suggest a need for renewed consideration of management strategies including more effective ways of linking research and extension, farmers and technicians. The main findings of interest of some important papers are given below :

M Mainul Abedin and R N Mallick from Bangladesh Agricultural Research Institute On-Farm Division, Joydebpur, Gazipur, Bangladesh presented a paper on *Shifting Towards a More Comprehensive Farming System Approach in Bangladesh*. More than 90 cropping patterns with associated available technologies was tested, adjusted and modified in 25 different agro-economic environments in 15 districts. Sixteen cropping patterns with associated technologies were recommended for multilocation testing. These patterns have a potential to increase yield from 11 to 160% and net income from 17 to 326%. The crop contribute 37%, livestock 7%, fishery 4% and forestry 3% of the total gross domestic product.

Dr Alex Cunard from USAID/Dar es Salaam, Washington, D C 20523 spoke on *Designing On-Farm Trials for Kilosa/Moshi District, Tanzania*. In this paper, the

* Based on the delegation report of Professor S S Cheema, Head, Department of Agronomy, Punjab Agricultural University, Ludhiana.

experimenters detailed about the plot size, cultural practices and implementation & management problems about the on-farm trials. They indicated to follow different approaches to trial design in different situations. J D Olukosi and A P Orungbile of Ahmadu Bello University, P M B, 1044, Zaria, Nigeria, presented their work on agriculture in Nigeria which is dominated by food and tree crop production (maize, sorghum, millet, cassava, yam, cocoa, oilpalm etc). New crop varieties and cultural practices have been developed in the research institutes and are currently being introduced to farmers through the on-farm adaptive research programmes. The large number of cattle found in the tsetse fly-free areas of northern parts of Nigeria constitutes an unexploited source of farm power. Livestock has not been integrated into the farming system in Nigeria. Farmers who grow crops, in general, do not keep cattle and vice versa. The use cattle as draught animals is considered a major technology that can overcome new labour bottlenecks arising from the introduction of improved crop practices.

This paper describes the pattern of animal farming and labour employment in two villages in Nigeria. The results indicate that although oxen traction was found to be both technically and economically superior to hoe farming, the reluctance of small scale farmers to keep cattle on their farms can hinder attempts to successfully introduce oxen farming. Problems associated with the use of oxen and that of introducing on-farm research programmes involving livestock management are discussed.

Richard A Riddle et al. from Institute Agronomique, Rabat, submitted their paper on Agricultural Education and Farming Systems Orientation in a Third World Context : The Systems Des Stages at the Institute Agronomique et Veterinaire Hassan II, Rabat, Morocco. Riddle and his associates from Morocco did not present the paper in person but the paper includes the students of Agriculture and Veterinary who were familiarised with rural areas through field research activities and were thus trained in understanding the complexity of agriculture system in relation to ecological and social environment. They were supposed to write extensive field reports and design applied agricultural development projects. The data collected by the students in the survey were useful to the researchers. Joel Teitelbaum, 2228 Richland Street, Silversprings, MD 20901 spoke on *Farming System Research : Human Methods Versus Managerial Problems in Western Sudan*. To carry out farming systems research in the drought-prone Western Sudan calls for multidisciplinary flexibility and managerial innovation. Interview methods used with tribal farmers and herders needs informal, exploratory reconnaissance working together across disciplines. Researchers must reach out to accessible communities of cultivators and transhumant herders, as well as to those in the private marketing and governmental institutions.

This case study of the results of conflicting research values on the Western Sudan Agricultural Research Project (WSARP) examines the research methods applied by

formal questionnaire techniques compared to those using rapid informal techniques and the effects on herding and farming communities of project management actions.

S S Cheema (the delegate) and J N Kaul, Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab spoke on *Training Strategy for Middle Level Technicians in Farming Systems Research and Extension*. Farming system research involves an integrated multidisciplinary approach towards developing a package of farming systems technologies for farmers to sustain agricultural productivity and increase income. Any disorder or imbalance in the components of the system could result in its breakdown. To operate and sustain the 'system', an adequate manpower at professional, intermediate and junior levels becomes necessary. The professionals are those receiving education and training in the specific fields at the universities whereas the intermediate/juniors are the products of polytechnics and colleges of technology. The intermediate/junior cadre constituting the technicians form the active contact-agent with the farmers and are instrumental in the transfer of a recommended package of technology appropriate to production programmes in the bio-physical and socio-economic environment. It is these personnel, who have to infuse the FSR/E network with new opportunities and challenges. Such personnel after having acquired the requisite expertise through the training programme being proposed should also be able to plan out the diversified farm enterprises and operate them independently besides serving as a demonstration for others.

Visualizing the importance of the training, there is a need to formulate a strategy for training in intermediate/junior level staff in FSR/E techniques. Schools where a two year non-degree training course involving all the major discipline components of FSR/E need to be established. Personnel with basic school education may be admitted to the school. A unique concept of field training through establishment of a multi-disciplinary 'Students Farm' designed with blocks in each subject discipline of the systems is proposed. The 'Students Farm' may be named 'Farming Systems Research and Extension Subjects Practicing Block' and should be attached to managing the component blocks of the system at the same time. The strategy should be tailored to achieve 60-70% emphasis on practicals with the theory concepts invariably explained in-situ. The programme may be operated on 'Earn While You Learn' basis. The chief pointers for creating keen competition and infusing confidence among the trainees are the 'See and Believe' and 'Do and Believe' components blended in the training programme. The Sokoto River Basin Development Authority's School of Irrigation and Extension Services, Federal Government of Nigeria introduced this training strategy and was practiced in its totality with good success. The content of the curriculum and the requirements for physical facilities and instructional materials necessary for such level of trainees was illustrated. The paper also emphasized the need of a feedback system including conduct of 'Open Houses' with a view to keep the training processes a dynamic one.

Eduardo Zaffaroni et al., Agronomy Department, North Dakota State University, Fargo, ND 58105, presented their work on *Developing Farming Systems for Small Farmers in Paraiba State, Northesat Brazil*. The authors had indicated the need of knowledge of existing farming systems for development of new farming systems. The objectives of their study were : a) to identify and analyse socio-economic characteristics of the target groups of farmers; b) to determine the structure production costs for each social strata; and c) to determine the economic efficiency of the different farming systems through analysis of profitability, sensibility and return to the production factors. They studied the social aspects, technical aspects, marketing aspects, and they made the economic analysis of the various cropping systems. They identified intercropping of cotton/corn/beans and intercropping cassava/corn beans. The first system had the higher production cost. In both cropping systems, the manpower was the greatest production cost. The production analysis showed the intercropping cassava/corn/beans had the higher profit. The sensibility and return to production factors analysis determined that the same cropping system was more attractive.

From these data, alternative cropping systems will be planned for the two dominate intercropping systems. An agronomic assessment and an adaptation evaluation of new technologies will be carried out. These new technologies are expected to increase the productivity of existing farming systems and consequently the welfare of small farmers.

H C Sharma and Narinder Singh, Haryana Agricultural University, Hissar presented their paper on *Integrated study of crop and livestock systems in Haryana State (India)*. In India, crop production goes in hand with livestock rearing. Farmers, whether large or marginal prefer to rear their animals rather than buying milk or milk products. However, there is no adequate data available on investigations conducted on integrated farming enterprises. Studies on different combinations of enterprises adopted by the farmers in three districts of Karnal, Hissar and Mahendergarh, representing the northern, western and southern agro-climatic regions of the State, were therefore, undertaken to find out the main differences in the cropping patterns, inputs used and production of different crops and livestock under different sizes of holdings viz. large (more than 10 areas), medium (5-10 acres), small (below 5 acres) and landless.

The studies have revealed that cropping patterns differed considerably in different regions depending on climate, water supply, and size of holdings. In Karnal district (northern region with an average rainfall of 800 mm and adequate water supply, rice and wheat were the first ranking crops and maize and sugarcane were the second ranking crops. In Hissar district (Western region) with a rainfall of 400 mm and canal water supply, pearl millet, wheat and gram were the first ranking crops and

cotton and rabi oilseeds are the second ranking crops. In Mahendergarh district (southern region) with 550 mm of rainfall and restricted water supply, pearl millet, wheat and gram were the first ranking crops with barley, guar and oilseeds as the second ranking crops. The livestock were fed roughages, straw and stalk, the byproducts of farm crops. The area under fodder crops was much less than required for feeding livestock. There is need to increase area under fodder crops.

The average number of animals maintained were 5,3 and 5 in Karnal, Mahendragarh and Hissar districts respectively. Buffalo and calf rearing were the major livestock enterprises. Bullocks which were the main source of draught consisted of 23.8, 19.3 and 21.5% of the livestock. Percentage of bullocks was found to increase with increase in irrigation facilities. However, with increase in land holdings, bullocks were being replaced by tractors. On an average, a buffalo gave 1904, 1712 and 1584 litres milk in a lactation period of 251, 255 and 261 days, making an average daily milk yield equal to 7.6, 6.7 and 6.1 litres in Karnal, Hissar and Mahendragarh regions. Murrah buffalo rearing was more profitable than a Haryana cow, while crossbred cows were higher yielders and more economical than buffaloes. Thus there is a need to lay more stress on introducing crossbred cows.

The landless families were mainly dependent on working as labourers for big farmers or renting land for cultivation of different crops. In Karnal district the landless were rearing poultry and pigs, in Hissar, poultry and sheep, while in Mahendragarh, sheep and goat were raised during the lean period of the year. It is suggested that the landless should introduce crossbred animals which would increase their profit. The advantages and income from mixed farming, i.e. crop and livestock enterprises, were much higher than arable (crops) farming.

The farming systems research and extension programmes is a very complex system and the methodology for research and training programmes have still to be perfected. The training needs of the middle level technicians and professionals and the designs to be adopted for carrying out research and extension programmes still are at the experimental stage and there is certainly a need to formulate research projects on farming systems as a whole rather than on individual aspects of the system. The work on these lines needs to be taken in hand in India also.

III ASIAN PACIFIC SYMPOSIUM ON CARDIAC PACING AND ELECTROPHYSIOLOGY : A REPORT

Dr K K Sethi attended and participated in the Third Asian Pacific Symposium on Cardiac Pacing and Electrophysiology held in Melbourne, Australia, from October 27-30, 1985. The symposium was sponsored by the Asian Pacific Society of Cardiology and the International Cardiac Pacing Society. The theme of the conference was 'Widening Indications for Cardiac Pacing'. This continuing medical education activity was designated by the North American Society of Pacing and Electrophysiology for 18 credit hours in Category 1 of the Physicians Recognition Award of the American Medical Association.

The first Asian Pacific Symposium on Cardiac Pacing was held in Jerusalem, Israel, from June 16-19, 1980. The second symposium was scheduled to be held in 1983 in Manila, Philippines, but had to be cancelled because of certain circumstances. The third symposium was held in Melbourne, Australia in October, 1985. The aim of the conference was to exchange up-to-date research ideas in the rapidly advancing field of pacemakers and electrophysiology, and to discuss the problems faced by the underdeveloped countries in providing pacemakers to the patients.

Conference Report

The main conference was preceded by pre-symposium/workshops on the afternoon of 27 October, 1985 in which Drs. Seymour Furman and Jerry Griffin (USA) discussed the controversial indications for permanent cardiac pacing and the basic techniques of conducting electrophysiological studies to guide therapy for rhythm disturbances of the heart. The conference was inaugurated on the morning of 28 October 1985 by Professor Sir Gustav Nossal CBE, FRS, FAA, FRACP, FRCP, Director, The Walter and Eliza Hall Institute of Medical Research, Melbourne, Australia.

Simultaneous sessions on pacing in Ischaemic Heart Disease and Cellular Electrophysiology were held. Dr William Mandel (USA) presented data on long term follow up of patients with permanent pacemakers implanted following acute myocardial infarction. This is a controversial issue and the beneficial effects of pacing in improving longevity or preventing sudden death in this subset of patients is not yet clear. Dr Yoshio Watanabe (Japan) highlighted the future of micro-electrode research in

* Based on the delegation report of Dr K K Sethi, Assistant Professor of Cardiology, G B Pant Hospital, New Delhi-110002

understanding cellular mechanisms of cardiac arrhythmias which could have significant influence on choosing appropriate antiarrhythmic drugs.

A separate session was devoted to the problems in the development of pacing services in the Asian-Pacific region. Representatives from People's Republic of China, Indonesia, Taiwan, Korea, Pakistan, India, Hong Kong and Australia participated and presented their data. It was realised that the cost of the pacemaker was the most prohibitive problem in providing the device to patients in underdeveloped countries. Of all the countries in the Asian Region, India is doing relatively better in implanting the usual as well as the advanced Dual Chamber Pacemakers.

Dr Paul Gillette (USA) provided extremely useful information on indications for permanent pacing in children and adolescents. He stressed that if the heart rate is less than 55 per minute in a new born, less than 45/min in a child or less than 40/min in an adolescent, permanent pacemaker is indicated to prevent sudden stopping of heart activity. Dr Rogger Mee (Australia) discussed the implantation techniques as they differ from those in adults, and emphasised the benefits of placing pulse generators in the abdominal wall in children. In adults, the pacemaker is usually placed high on the chest wall, below the clavicle.

One of the major problems facing the cardiologists today is occurrence of sudden death in a high proportion of patients who survive an acute myocardial infarction. A session was held on this aspect in which the markers to identify such high risk patients were discussed. Excellent studies were presented by Dr John Uther from Sydney (Australia) in which he showed that by combining results of exercise testing and intracardiac electrical stimulation in patients of acute myocardial infarction before hospital discharge, it is possible to identify almost all patients who are likely to have problems in the next one year. However, this involves an invasive investigation and placing catheter electrodes inside the heart. Dr Thomas Peter (USA) stressed upon the need to develop a non-invasive technique, and showed results of surface ECG recording by the technique of signal averaging that can identify such high risk patients. The role of drug treatment in prevention of sudden death in such patients is not yet clear and is being extensively investigated at present.

Till a few years ago, only one type of pacemaker with pacing capabilities in the ventricle was available. More recently, dual chamber pacemakers with pacing and sensing capabilities in both atrium and ventricle have been developed. These are known as the physiological pacemakers which have the capacity to increase the heart rate in accordance with the needs of the body. Some patients with diseased atria, however, are unfit for use of such pacemakers. For such individuals extensive research is being carried out to find alternative sources for sensing physiological needs of the body so as to allow the pacemaker to change its rate. Data on use of muscle activity, respiratory

parameters, blood temperature and blood pH as sensors for selecting optimal pacing rate was presented from West Germany, Japan, and USA. Finally, a session was devoted to development of soft-ware based pacemakers, and utilisation of computers in follow up of pacemaker function.

In addition to the symposia and invited lectures about 200 free papers were presented in the conference. The delegate chaired one session entitled *Pacing Services in the Asian Pacing Area* on 29 October, 1985 and also presented the following two papers : (i) *Differential Effects of Autonomic Blockade on Sinus and Atrioventricular Nodal Function in Patients with Intrinsic Sinus Node Dysfunction*. Little information is available in the literature on this subject. This paper highlighted that autonomic nervous system has dissimilar effects on sinus and atrioventricular nodes in normal individuals, and provided for the first time, the incidence of true A-V nodal conduction abnormalities in sinus node dysfunction. (ii) *Use of Tined Ventricular Leads for Permanent Atrial Pacing*; This technique for atrial pacing is utilised by only a few centres in the world and was highly appreciated by the scientific committee of the Conference. This paper won an award certificate and being included in the top 10 abstracts on cardiac pacing. The top 40 per cent abstracts were published in the leading American Journal "PACE". Both the delegates' papers were published, and incidentally happened to be the only two abstracts published from India.

Post-Symposium Seminars

After the main symposium concluded in Melbourne, two post symposium seminars were held in Sydney. On 1 November, 1985 the seminar on "Controversies in the Prevention of Sudden Death" was chaired by Dr John Uther from Australia. It was the consensus of opinion that most cases of sudden death are caused by ventricular fibrillation. Treatment strategies regarding use of drugs, surgery, electrical ablation of arrhythmogenic focus, and implantation of defibrillators were discussed by Drs. John Camm (UK), David Johnson (Australia), G Fontaine (France), and Roger Winkle (USA). The best modality for treatment of patients with failed sudden death is not yet clear. Possibly all these modalities will have some role to play in individually selected cases.

On 2 November, 1985, a seminar on new sensors in pacing was chaired by K Hellestrand (Australia). Rate responsive pacing and data on use of non-cardiac sensors like muscle activity, Q-T sensors, temperature sensors and respiration was presented. The conference was concluded on the note that against the background of recent developments in the field of cardiac pacing and electrophysiology one could hope in very near future for a considerably improved care of patients suffering from life threatening rhythm disturbances of the heart.

V SABRAO INTERNATIONAL CONGRESS : A REPORT*

Professor G M Reddy attended the V International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO) held at Kasetsart University, Bangkok, Thailand from November 25-29, 1985, with a focal theme on *New Frontiers in Breeding Researches*. This international symposium was organised by Kasetsart University in cooperation with Ministry of Agriculture, Ministry of Science and Technology and Energy, the Agriculture Science Society of Thailand and the Government of Thailand. Plenary lectures were given by invited speakers on current aspects of breeding researches to stimulate discussion on some of the congress themes and/or to provide over reviews and the state of art in breeding researches, genetic engineering and biotechnology. About 250 delegates from 25 countries participated in this symposium. Various sessions included genetic engineering and biotechnology, crop genetic resources, genetic improvement in animals, genetics and breeding for resistance, nitrogen fixation, plantation crops, grain legumes and oil seeds, rice, maize and sorghum, soyabean, tropical vegetables etc.

The first plenary session started with the keynote address by Dr M S Swaminathan, Director, International Rice Research Institute, Manila, Philippines, on *International Cooperation*. In the session on *Biotechnology and Genetic Engineering* papers on various aspects of plant and animal science were covered. Professor V L Chopra, Biotechnology Centre, IARI, New Delhi highlighted the exploitation of protoplast technology in gene manipulation in higher plants. More emphasis was laid on somaclonal variation in *in vitro* cultures by Dr S A Ryan (Australia), Dr A H Zakri (Malaysia) and application of another culture in rice breeding by Dr Huang and others (Republic of China). Dr Hirobe (Japan) explained that the expression of characters is changed by different cytoplasm and thus cytoplasmic actions play an important role in breeding. Dr Wang lin-qing (China) reviewed the advances in mutation breeding over the past four decades and concluded that about 180 improved varieties including cereal crops, oil crops, vegetables, fruits etc., have been developed which led mutation breeding into a new stage of development. Dr Bjorn Sigurbjouson of FAO/IAEA, spoke on twenty years of coordination of mutation breeding research in Asia between FAO and IAEA.

Dr T Mukherjee of University of Malaya described the recombinant DNA procedures as tools of improving performance of livestock—prospects and problems.

* Based on the delegation report of Professor G M Reddy, IANA, Department of Genetics, Osmania University, Hyderabad 500 007.

A brief review of the knowledge on plasmids, C DNA and RNA involving domestic animals was presented. The session on *Genetics and Improvement of Animals* included presentations and talks on livestock and sericulture improvement.

In the session on *Crop Genetic Resources*, breeding methodologies of triticale, wheat, forage plants etc., were presented. Genetic and breeding aspects of wheat were reported by scientists from IARI (New Delhi), Punjab Agricultural University (Ludhiana & Gurdaspur) and University of Agricultural and Technology (Khanpur). Dr A Santiago and S N Santiago of Malaysia, discussed about the computer breakthrough in integrating a mathematical system of biological systematics. Dr P K Gupta and G Fedak spoke about their experiments on wide crosses for improvement of wheats and Barley. Some of the hybrids studied for morphology, meiotic pairing, indicated possible transfer of desirable traits like perennial habit, salinity tolerance, disease resistance etc. In addition to these, papers on exploitation on crop genetic resources in Sri Lanka and germplasm collection of indigenous strains of glutinous corn in Thailand were also presented.

In the session on *Genetics and Breeding for Resistance*, papers on breeding for resistance in economically important crop plants such as rice, wheat, cotton, sesam, cowpea, Indian mustard and okra. In addition, response of sorghum, wheat and barley to drought conditions were reported. The rice breeding programme in Indonesia developed an intensive programme to improve varieties and thus, since 1971, 50 improved varieties have been released which are resistant to major pests and diseases.

The next session was on *Nitrogen Fixation*. Salisbury from South Australia reported the effects of mineral nitrogen on nitrogen fixation by annual legumes. Character associations, physiological function and modulation in black gram and their implication in improved seed yield were reported by P K Das and T Das Gupta from Kalyani (West Bengal). The authors identified significant plant characteristics which effect seed yield in black gram and hoped that such an analysis would help to breed high yielding genotypes. J C Yang (Taiwan) and J G Torrey (USA) presented their findings on the variation on symbiotic association of two Asian alders (*Alnus* sp.).

The session on *Plantation Crops* included presentations on rubber, cassava, oil palm, *Havea*, sugarcane, jute, coconut etc. Much emphasis was laid on how to exploit the genetic resources in crop research under a locale. Dr Ong and others from Rubber Research Institute, Malaysia, reviewed the evaluation and utilization of *Havea* germplasm in Malaysia. In oil palm, genotype and environment interactions for bunch yield, bunch characteristics and vegetative growth were discussed by Ong *et al.* (Malaysia), clonal propagation and the effects of current D X P seedling materials on yield, increase and clonal propagation, were described by A C Soh (West Malaysia) and Raja Naidu and A H Hassan (India) reviewed the utilization of oil palm genetic resources. Coconut breeding and research strategies were reviewed by Bavappa and Bhaskara Rao from CPCRI, Kasargod, India.

Session on *Oilseeds and Legumes* mainly dealt the research on soyabean breeding, use of *Atylosia* germplasm in pigeonpea improvement, improvement of mungbean, cowpea, chickpea, greengram, groundnut, mustard sesame, linseed, safflower etc.

Session on *Rice* highlighted the studies on inheritance of various characters, such late heading, grain size, etc. Tsunoda (Japan) reviewed the studies on differentiation of *Japonica*, *Javanica* and *Indica* rice in different ecosystems. Misra and others from Cuttack have identified trisomics in rice which were useful in assigning genes to specific chromosomes. An interesting report on the heritability estimates of nitrogen fixing ability of rice was presented by Iyama *et al.* of Japan, which concluded that nitrogen fixing activity may be improved by hybridization and selection. Dr Eudo (Japan) reported on the electrophoretic characterization of endosperm protein of rice which yielded higher levels of glutelin and low levels of albumin, globulin and prolamins. S S Mondal and others from Burdwan University, West Bengal, presented paper on *Isogenic Breeding and Genetic Tailoring in Rice*. Certain characters showed wide variation providing scope to select isogenic/isoallelic progeny plants. SJ Chang, reported on the use of genetic diversity in rice production with special emphasis on pest management. Multivariety method of breeding was employed to see the control or reduction in disease epidemics.

Varietal improvement of maize and sorghum was stressed in the section on *Maize and Sorghum*. A S Kehra from Punjab presented papers on introgression of corn belt germplasm of maize and breeding for adaption to winter season. The authors also reported somatic embryogenesis in some composite varieties. Othman *et al.* (Malaysia) presented their findings on the relationship between *brachytic* gene and peroxidase activity and isozyme expression.

Other sessions included on *Soyabean* and on *Tropical Vegetables*. Most of the reports were on the genetics of resistance of soyabean cultivars to leaf rust, and identification of varietal sources of resistance. Tan Yu-jun of China has reviewed the epigemiology of soyabean rust in China. Various vegetable crops like chilli (*Capsium annum*), winged bean, Tomato, aibika (*Abelmoschus manihot*), *Allium*, *Brassica* were reported on their breeding strategies and genetical analysis. A poster session also included few poster presentation on genetics and breeding of mango, chickpea, pigeonpea, and sugarcane.

IBPGR/SEAP Workshop

A workshop on *Problems and Prospects of Characterization and Preliminary Evaluation of Crop Genetic Resources* was organized by International Board of Plant Genetic resources of South East Asia and Pacific from 25-27 November, 1985. Introductory remarks on the characterization of germ plasm in South East Asia were given by Narong chomchalow (IBPGR) and R B Singh (FAO), followed by

keynote address by Otto Franker (CSIRO) on *Characterization and Evaluation : what, Why and by Whom*. This workshop included presentations on the evaluation of germplasm/gene pool of important crop like maize, groundnut, pigeonpea, mungbean, sweet potato, wheat, citrus, sugarcane, capsicum, mango, papaya etc. A talk on Evaluation of Genetic Resources with special reference to Genetic Analysis was given by F Kikuchi (Tsukuba University). Emphasis was given on the need for characterizing crop germplasm in terms of the demands of the breeder and challenges of the environment.

Conclusions

The main emphasis of the SABRAO congress was to review and reassess the existing breeding methodologies for cereals, legumes, oilseeds and tropical vegetables in South East Asia and Pacific which come under International Board for Plant Genetic Resources (IBPGR). The recombinant DNA technology and development of genetic engineering techniques have been reviewed for their implications in crop and livestock improvement. Another frontier area of research, which was given attention was somaclonal variation. It was stressed that somaclonal variation should be applied in various ways to plant breeding, such as *in vitro* mutant selection and improved lines, and single gene homozygous mutations at many loci.

The papers reported at the congress by many scientists including those from India, mostly dealt with the conventional breeding strategies for crop plants. Only a few have mentioned the use of plant tissue culture, somatic embryogenesis, somaclonal variation in crop improvement which needs to be exploited in crop plants.

The workshop on *Evaluation Characterization of Germplasm Resources* involved presentations and discussions on the existing and available crop germplasm in India, Thailand, Indonesia and Philippines. Both the SABRAO Congress and the IBPGR/SEAP workshop provided the opportunity for the delegates to participate in the discussions and exchange their views on research areas of interest, and immediate attention.

II CONGRESS OF THE MEDITERRANEAN SOCIETY OF THERAPY : A REPORT*

Professor T K Shanmugasundaram attended the II Congress of the Mediterranean Society of Therapy at Istanbul from 20-25, July 1986. The Mediterranean Society of Therapy is an apex organisation for the advancement of science and art of therapy embracing almost all branches of medicine. The members of the society are internal medicine specialists from various disciplines. The scientific programme consisted of 38 sessions, 24 symposia, 2 workshops, 11 paper sessions, 2 poster sessions and 7 invited papers. It was a heterogenous programme with various therapy and gave a good cross-section of science of treatment of today. The subjects included paediatric infections, infective disorders, chemotherapy of infections, several sessions on anti-coagulants, cancer chemotherapy, radiation therapy, biological response modifiers and immuno-restoration, to quote only a few.

It is praiseworthy that the organisers of the congress thought it fit to arrange a 'Round Table Conference' on *Bone & Joint Tuberculosis* on the occasion. Even though the invitation to participate at such Round Tables are usually restricted to the medical men of the Mediterranean Region, the organisers have honoured India by inviting one of its orthopaedic surgeons. The present delegate, to present three of the eight papers read at the RTC on *Bone & Joint Tuberculosis*.

Professor A Blasi (Naples, Italy) traced *The Natural History and Evolution of Knowledge*. The extrapulmonary tubercular foci account for 25 per cent of the disease. The incidence of bone and joint tuberculosis varies from country to country forming 9-10 per cent in Italy in 1978 with a male preponderance while it was 31 per cent in Algeria in 1973 with a female preponderance. He gave, a resume of the regional distribution, microbiology with *Mycobacterium tuberculosis* accounting for 859-5 per cent of the infection, and described the pathological manifestations and pathogenesis of the skeletal tuberculosis. Dr D Keniazi (Istanbul, Turkey) spoke on *General Considerations in Diagnosis of Bone and Joint Tuberculosis*. Giving statistical figures for Turkey (1981-85), he informed that B & J Tuberculosis accounted for 1.1% patients in sanatoria beds, 10.8% in orthopaedic hospitals and 0.16% in TB dispensaries.

* Based on the delegation report of Professor T K Shanmugasundaram, Head of the Department of Orthopaedic Surgery, Madras Medical College & Government General Hospital, Madras-600 003.

Professor M Martini (Tipaza, Algeria) spoke on *Practical Considerations in B & J Tuberculosis*. He laid emphasis on clinical diagnosis consisting of clinical signs, radiological findings, laboratory findings and biological response and on scientific diagnosis or proven diagnosis by histology and/or bacteriology. He emphasised that the biopsy must be done by a senior surgeon and enumerated the pitfalls to be avoided. Professor D Larbaoui (Algeria) spoke on *The Modern Chemotherapy of Bone & Joint Tuberculosis*. He divided the consequences of the discovery of anti-TB drugs into :

- I) Scientific consequences based on bacillary resistance, bacterial activity and sterilising activities and
- II) *Human Consequence* : 1) Individual level. a) Hospitalisation and bed rest are not necessary ,b) The intermittent treatment and of shorter duration afford better comfort and security for the patients. 2) Collective level. a) The chemotherapy reduced the infecting density of the environment by speedy sterilisation of the source of infection i.e., sputum of cavitary pulmonary lesions, b) The reduction of community expenses for the therapeutic and social care of the patients are substantial.

Larbaoui gave a historical review of short course chemotherapy for pulmonary and Bone and Joint tuberculosis. He paid tributes to the activities of the Tuberculosis Research Centre in the dissemination of knowledge of the subject. He felt that short course chemotherapy is eminently suited for Bone and Joint TB for the following reasons : i) fewer bacilli ii) closed lesions and very badly oxygenated and iii) bacillary property of the lesion make it impossible of selection of instant resistant bacilli. He found the results of short course regimens for six months for Bone & Joint TB at Algiers (Martini et al.) satisfactory.

Professor TK Shanmugasundaram (Madras, India) spoke on *The Orthopaedic Measures*. The orthopaedic management of bone a joint tuberculosis was largely empirical till the early forties of this century. With the advent of the specific chemotherapeutic drugs, there has been a dramatic change in the natural history of the disease at all sites including bones and joints. The needs for care in sanatoria and for prolonged periods of immobilisation have become redundant. The skeletal lesions present as osteoarticular, synovial, osseous lesions or a combination of these. Bone and joint lesions have fewer organism compared to pulmonary lesions. Hence the drug resistance and related problems are likely to be less. These lesions are eminently suited for short course regimens and for excisional surgery.

The principles of treatment depends on the region affected, the stage of the disease and the facilities available in a given set-up. With the advances in anaesthesiology, monitoring and transfusion services, the frontiers of surgery for skeletal tuberculosis have been extended to regions like the spine and the hip joint. The

presentation included a short historical survey with emphasis on the principles of treatment based on the clinical manifestations like pain, muscle spasm, deformity and joint stiffness.

The delegate also spoke next on *The Problems of Treatment of Tuberculosis of Spine without CNS Involvement and Prediction of Gibbus Angle*. The vertebral column was the commonest site of skeletal tuberculosis with 50-60% incidence. The great majority of patients respond to chemotherapy with the potent drugs available at present. The controlled clinical trials of M R C of Great Britain in various parts of the world, such as Korea, Hong Kong, Bulawayo and Madras have shown the effectiveness of the anti-tuberculosis chemotherapy for spinal tuberculosis. Strict bed rest was no longer necessary excepting for short periods for severe pain. The methodology and long term results of Madras Study of Tuberculosis of Spine were described.

The surgical treatment was often indicated for the complications of spinal tuberculosis like cold abscess, gibbosity and cord compression. The merits of radical excision and bone grafting popularised by Hodgson in shortening the period of treatment and prevention of deformities are well known. Cosmetic correction of recent or long-standing gibbosity by staged procedures was possible. However, neurological complications can occur after too rapid correction.

An in-depth study of ninety patients of the Madras Study revealed that in the conservatively treated cases, the end gibbus angle depends on the initial vertebral loss and can be predicted fairly accurately. This finding may be of immense help in the selection of cases of radical resection and bone grafting to forestall severe deformity of the spine. The presentation included the principles of management at different levels of the vertebral column with illustrative cases, the relevance of short course chemotherapy for spinal tuberculosis, the results of Modified Hong Kong operation, the fate of rib grafts and a method of prediction of end gibbus angle based on the initial vertebral loss.

The Chairman requested the orthopaedic surgeons among the panel members, Professor M Martini and Professor TK Shanmugasundaram, to present their papers on Pott's Paraplegia.

Professor M Martini gave an account of the pathology, the clinical features and the usefulness of CAT Scan to delineate the compressive elements. He felt that the chemotherapy should be given for 12 months. The prognosis was better in children, spastic paraplegia, CNS deficit of less than 12 months and in-patients with minimal or slight gibbosity. He advised surgery for bony or discal compression. He felt that vascular complications of the spinal cord can occur after surgery.

Professor TK Shanmugasundaram, emphasised that the involvement of the spinal cord is one of the severe, dreaded complications of the tuberculosis of the spine.

It is probable that about 15 per cent of the patients with spinal tuberculosis suffer from it. The intensity of the cord compression depends on many variable such as the activity of the disease, the level of the lesion, the pathological nature of the compressive elements and the treatment received. Two distinct types are discernable, the paraplegia of the active disease and the late onset paraplegin. In the former type, a large proportion of patients respond to antituberculosis chemotherapy.

Several operative procedures are described for surgical decompression of the spinal cord of which the anterior decompression and bone grafting seems to be most rational procedure. A controlled clinical trial on Pott's Paraplegia, probably the first of its kind in the world is in existence at Madras. The interim findings of the study was presented. The presentation included the natural history of the lesion seen in a personal series of over 500 cases in three decades. It was compared with several large series from other regions of India, Algeria and Korea.

During discussion in which all the panel members had joined, the role of Short Course Chemotherapy for bone and joint tuberculosis, the indications for surgery in spinal tuberculosis and the role of BCG among other matters were highlighted.

Recommendations/Conclusions Arrived at Conference

There was universal agreement on the role of Short Course Regimens for Bone & Joint Tuberculosis. The prediction of gibbus would go a long way in prevention of gross deformities in children. While Professor Martini was unsure of the role of surgery in Pott's Paraplegia, this delegate's opinion on the indications for surgery based on the controlled clinical trials at Madras was accepted by the panel members.

Impact of the Present Conference on Research Work in India

The recommendation of the RTC for the use of Short Course Chemotherapy for Bone and Joint Tuberculosis was based on the effectiveness of the regimen in Algeria, Hong Kong, Korea and India.

The need for the controlled clinical trials on Pott's Paraplegia was emphasised. It is rather unfortunate that the only trial of such a nature in the world at Madras had been terminated recently by Tuberculosis Research Centre (a division of Indian Council of Medical Research). The revival of grants from ICMR or any other scientific body would go a long way to continue the trial. The results of such a study would indicate the role, if any, for surgical intervention for relief of Pott's Paraplegia.

II ORGANIZATIONAL MEETING ON IGCP PROJECT ON WORLD-WIDE COMPARISON OF ACTIVE FAULTS : A REPORT*

Professor K S Valdiya participated in the II Organizational Meeting of IGCP Project on World-wide Comparison of Active Faults (a UNESCO Project) and its field trip at State Seismological, Bureau Beijing, China from 5-13, November 1985. The conference was attended by 16 foreign delegates from Peru, USA, UK, Turkey, India, Nepal and New Zealand and as many as 30 from different parts of China. It was an interdisciplinary meeting of geologists and geophysists engaged in the studies on active faults—their recognition–delineation, physiographic expression, tectonic nature and crustal deformation, seismicity and related hazards. The objective of the meeting was to produce a multivolume atlas for the comparison of active faults worldover.

The highlight of the conference was the demonstration of comprehensive work the Chinese have done on the many active faults in eastern, southeastern, southern (Tibetan) and southwestern (Sinkiang) provinces. The delegates were greatly impressed by the volume of work they have done and by the large number of scientists involved in the project.

The meeting also provided an excellent opportunity to gain firsthand knowledge of the geology of the province of Shandong in Eastern China during the five day field work that embraced the sectors Yidu-Linqu-Ju, Ju-Junan-Linyi-Tanchang-Linyi, Linyi-Qufu and Qufu-Jinan.

Delegate's Contribution

All the three latitudinal *lithosctonic* domains of the Himalaya are experiencing neotectonic activities. The intracrustal boundary thrusts and tear faults cutting the mountain are transversely are particularly active. The movements on the Main Central Thrust (MCT) are responsible for spectacular uplift of basement rocks to the lofty eminence of the Great Himalaya.

The Lesser Himalaya with its mature old topography is being rejuvenated through episodic movements—3 to 5 or 6 phases in the Quaternary period. The

* Based on the delegation report of Professor K S Valdiya, FNA, Department of Geology, Kumaun University, Nainital-263001.

movements on transversely trending (NW-SE) tear faults are predominantly dextral strike-slip in the central sector (Nepal and Kumaun Himalaya), causing downthrow of the northeastern block relative to the uplift in the southwestern side. It is the movements along these conjugately paired faults which seem to account for higher seismicity of certain areas in the Himalayan province. These movements represent crustal accommodation taking place consequent on the convergence of Indian and Asian plates.

The Main Boundary Thrust (MBT) is seismically and tectonically more active than other faults, the movements being both dip-slip and dextral strike-slip. Even though the late Quaternary vertical displacement on the MBT has been variable from sector to sector, it is the Siwalik domain that has risen faster and higher (Uplifted) than the lesser Himalayan as evident from, among other features, uphill facing fault scarps (40-45 m) on pressure ridges and river terraces.

The uplift of the Siwalik between the MBT and as yet vaguely recognized Himalayan Front Fault (HFF) has caused its northward tilting and development of many intrabasinal faults. Across the geomorphologically poorly delineated and seismically yet inactive HFF, the Ganga Basin is progressively subsiding.

Recommendations/Conclusions

This being just the second year of the project 206, it was felt that it is too early to arrive at any conclusion concerning comparison on otherwise of the active faults world-over. In relation to Himalaya, the delegate was advised to incorporate the deductions and conclusions of the International symposium on Neotectonism in South Asia organized by the Survey of India at Dehradun from 18-22, February 1986. It was also recommended that records of historical and instrumental seismicity be represented separately in the form of epicentral maps.

The national correspondents were asked to prepare the following for the global Atlas of the Active Faults :

- I. Illustrations on $8\frac{1}{2}$ " \times 11" sheets, suitable for reduction by photocopier
 - i) Map of fault trace under study, to include latitude, longitude, scale.
 - ii) Map of country with areas of fault trace map
 - iii) Seismicity map
 - iv) Brief descriptive text in one page with Fault name, Fault type, Tectonic Setting, Other descriptive information to characterize the Fault.
- II. Contribution to project poster display. Illustrations for poster series to be used to describe the project at national and international meetings.

III. *Photocopy Atlas* : Reduction of atlas to the largest sheet size available on the photocopy machine that will be used.

To mail one copy to chairman of each national working group, include a statement describing any restriction of the use of the copy).

Possible Impacts on Indian Research Endeavour

Compared to about 15,000 Chinese earth scientists involved in comprehensive investigation of active faults, there are hardly 10 to 15 Indian earthscientists carrying out studies on active faults and related seismic hazards.

The delegate strongly feels that in the management of earthquake hazards in western, northern and north-eastern parts of the Indian subcontinent, multi-disciplinary studies related to faults and thrusts be intensified and carried out on comprehensive scale, involving universities and research institutes under a special project to be funded by the DST. The focus should be on neotectonic activities and seismic hazards. The earthscience departments of Poona, Roorkee, Kumaun and Gauhati and Wadia Institute and Survey of India at Dehradun are centres where such kind of studies can be intensified.

Important Discussions with Scientists and Other Experience

Intensive discussions were carried out during the five day field work, primarily related to neotectonics and seismic hazards. Two things are etched deep in memory : The Chinese have connected their towns and villages with networks of excellent roads—gently graded, wide, metalled and invariably tree-lined. The Indian engineers can learn a good deal from their Chinese counterparts on road-building technology. They have laid the road networks without damaging the stability of hillslopes, without hurting the integrity of natural environment.

The extensive experiments in social forestry is paying rich dividends. Even the petty village footpaths are lined with popular trees. On canal embankments they have raised bush green agroforests and the household plots and villages are all surrounded by trees.

Visit Associated with Conference

The Conference was followed by a five day field work in the Shandong Province in eastern China. It provided an excellent opportunity to gain first hand knowledge of the Phanerozoic-Quaternary geology of the seismically active eastern China. The sectors embraced are Yidu-Linqu-Ju, Ju-Junan-Linyi, Linyi-Tancheng-Linyi, Linyi-Qufu, and Qufu-Jinan.

Not only one could we see the geology and physiographic settings, but also the historical places (such as the birthplace of the great philosopher-saint Confucius) towns, villages and communes and the people of the rural world.

1985 INTERNATIONAL CONFERENCE ON COAL SCIENCE : A REPORT*

Professor V Mahadevan, participated in the 1985 International Conference on Coal Science at Sydney (NSW), Australia from October 28-31, 1985. This international conference was sponsored by the member countries of the international energy agency. The organising committee was represented by 10 countries. It is befitting that this conference was held in Australia, one of the major coal producing countries. They have planned to go in a big way to augment research and development in coal science and technology for various end-uses. Joint collaborative work mainly with Japan is envisaged.

This is the third international conference on coal science. Coal liquefaction was given maximum importance and 62 papers were presented on various aspects viz. processing, mechanism, catalysis and others. New techniques based on integrated approach using instrumentation analysis were stressed in the processing coal through R & D activities. The topics covered were :

- a) Coal liquefaction
- b) Gasification
- c) Combustion
- d) Natural oxidation
- e) Beneficiation
- f) Coal slurry
- g) Coal characterisation
- h) Coal petrology (microscopy)
- i) Coal structure and
- j) Pyrolysis.

Summary of the Papers presented at the 1985 International Conference on Coal Science **Coal Liquefaction**

Coal liquefaction has been given utmost importance and 62 papers were presented. The results of processing coal of various rank in continuous flow coal

* Based on the delegation report of Professor V Mahadevan, Department of Chemical Technology, Kharagpur-721 302.

liquefaction processes are reviewed in order to correlate liquefaction process requirements to rank-related coal properties. The results show that younger coals are more difficult to dissolve, but produce excellent oil yield at relatively low hydrogen consumption when processed in appropriately catalyzed continuous flow processes.

The use of H_2S as a promoter in coprocessing low rank canadian coals showed, in general, the use of H_2S (5-15 wt% based on m.a.f. coals) results in higher coal conversion and distillate yield for subbituminous coal, but little or no beneficial effect for lignites. H_2S was also effective in reducing coke formation during coprocessing.

Two stage upgrading was found to effectively denitrogenate and crack heavy coal liquids through the extensive hydrogenation in the first stage (approx. 380°C) and the effective hydrocracking in the second stage at a higher temperature (approx. 420°C). Selected Australian coals were liquefied in the presence of iron-sulphur catalysts at 20-30 MPA and 400-465°C with recycling of solvents in a bench scale reactor.

A mechanism has been proposed for the hydroliquefaction process (using victorian brown coals) which emphasises the role of catalysis in inhibiting repolymerization reactions, the significance of interconvertibility of coal derived products and the importance of hydrogen donation from molecular hydrogen and from the vehicle tetralin.

A novel approach in the R & D direction for direct coal liquefaction has suggested a mechanism on the coal dissolution; coal and donor solvent first form an 'adduct' possibly by both hydrogen and covalent bonds interaction. The hydroaromatic structure is more easily cracked thermally.

A new competitive concept, comprising of a mild low pressure hydrogenation followed by hydropyrolysis of the residue has been presented.

Brown coal liquefaction process developed describes the 50 tonnes/day pilot plant with about 170 tonnes per day of raw brown coal fed as feed-stock. The cost of the plant is about 150 million US dollars.

Characterisation and donor acceptor properties of coal liquefaction vacuum bottoms show higher molecular weights, higher aromaticity and increasing aromatic ring condensation.

Catalysis

Hydrogenation of bituminous and a sub-bituminous coal under mild conditions in the absence of solvent using an impregnated MO catalyst show that the low rank coal was more readily converted to liquids with a high oil to asphaltine ratio.

The catalysis of iron catalyst, iron ore as well as two types of iron compounds (ferric oxide, aerosols, ferric hydroxide precipitated from iron sulphate solutions) on direct coal liquefaction has also been discussed.

Deactivation of solvent rehydrogenation catalyst (Ni-Mo/Al₂O₃ catalyst) in coal liquefaction and its counter measures have been suggested. Hydroliquefaction of coal using various metal carbonyls as catalysts has resulted in high coal conversion (>90%) and high oil yield (>32%).

Brown coal hydrogenation has been studied in a batch autoclave with and without molybdenum emulsion catalysts. The catalyst was shown to be highly active and facilitated hydrogenation of the complex aromatic structures without affecting the cracking of aliphatics.

A series of promoters based on a transition metal ion (Co, Ni, Cu) and sodium aluminate, sodium silicate or magnesium acetate have been shown to be active for the liquefaction of brown coal in synthesis gas. Reaction mechanism was also discussed.

Others

A new catalytic procedure for low temperature depolymerisation was reported. Correlation of reactive indices and other properties of coal liquefaction distillates had been presented for the development of a database. A number of papers on kinetics for various aspects of coal liquefaction were also presented.

Good correlations were obtained between conversion and volatile matter of brown coals for supercritical gas extraction with toluene etc.

Gasification

The catalytic activity of a series of sodium salts in carbon-steam gasification has been studied and a possible mechanism has been proposed. Low cost inactive catalyst raw materials of mineral origin like potassium chloride and potassium sulphate has been found to yield the same effect as active catalyst if the activation is accelerated. Effect of several compound-catalysts on steam gasification of carbon has been presented.

Effectiveness of K₂CO₃ and Ni catalysts on the steam gasification of number of coals showed that K₂CO₃ effectiveness was considerably large, irrespective of the coal type and that of nickel strongly depended on the coal type and it was extremely large for low rank coals.

Inhibition of the reactivity of petroleum coke to steam, by hydrogen had been reported. Mineral matter behaviour in high carbon conversion coal gasifiers is of

concern because it governs deposition on gasifier internals and hot cyclone surfaces, agglomeration in agglomeration gasifiers and slag removal in slagging gasifiers.

Production of hydrocarbons from carbon monoxide-hydrogen-steam mixtures over cobalt and nickel catalysts have been studied.

A new catalyst formulation was described for converting synthesis gas into a highly aromatic gasoline using a single fixed bed reactor. When an intimate mixture of the precipitated iron-potassium catalyst and of the H-ZSM-5 zeolite is used, no formation of aromatics in the liquid phase is observed. But large quantities of olefin and heavy hydrocarbons are recovered. The selective production of a highly aromatic gasoline from synthesis gas is possible in a single fixed bed reactor using an appropriate mixture of a Fisher-Tropsch catalyst with an acid ZSM-5 zeolite.

The Premium Coal Samples

It is important that the coal samples used for experimentation are representative of the seam and are as near the *in-situ* state as possible. The ultimate quality of the samples depends on great care at each of the successive steps in the process viz. selection, collection, transportation processing, packaging, characterisation and analysis, storage and distribute. Special coal sample preparation was suggested.

Coal Characterisation

On coal characterisation, the following points were worth the consideration :

The classification and characterisation of coals require a knowledge of the origin of coal and of the reactions undergone subsequent to the formation.

The natural gamma ray characteristics of fresh and oxidised coals determined by the ratio of thorium/uranium activity can be used to differentiate them both in the laboratory and downhole situation.

A new classification system for South African coals (Gondwana coals) has been proposed correlating coal petrography, based on vitrinite reflectance and various properties. Such a system could be tried for Indian coals, as well.

Coal Benefication

The possibility of using solar dried coal slurry process (SDCS) for the upgrading of low rank coals by slurring in water, fine grinding and/or alkaline degradation and solar drying has been investigated.

Steam drying of coal using steam fluidised beds offer the benefits of energy economy arising from multi-effect evaporation. The product cost is \$47-\$65 tonne dry coal, with transport and raw material accounting for more than half the cost ($\approx 65\%$).

A new technique for generating coal surface energy vs. mass distributions was developed. These surface selective distributions can be correlated with surface oxygen functional group concentrations. Both coal susceptibility to oxidation and rate of oxidation can be quantified by these techniques.

The deterioration in agglomeration properties of coal, due to oxidation, can be primarily attributed to oxygen containing surface functional-groups i.e. carbonyl and to a certain extent hydroxyl formation. This oxidation could be successfully counteracted by active-site reduction and blocking.

Agglomeration of low rank coals using oil-agglomeration technique has also been discussed. Knowledge of the influence of petrographic composition on the washing process, helps in determining the nature and cause of quality variation and in developing methods of optimising coal quality, both of ROM and ex-washing stages.

An understanding of the flotability of petrographic constituents is very important in the preparation of coals for various processes because the petrographic composition of coals has a great effect on their behaviour in these processes.

The different floatability of petrographic constituents and changes of floatability with degree of coalification have been explained in terms of the structure of petrographic constituents.

The influence of surface properties on the floatability of coals is strongly dependent on its particle size. In the case of large particles it directly affects the detachment probability whereas with small particles, it only indirectly influences. An easily determined quantitative measure of the balance between hydrophobic and hydrophilic tendencies had also been proposed.

Selected silicones performed as well or better than kerosene when used as collectors in the cleaning of selected fine coals by froth floatation. The main action of the silicone is to get adsorbed on the coaly grains and render their surfaces more hydrophobic.

Chemical coal beneficiation of low ranks by oil agglomeration and subsequent oil recovery may eventually lead to an important method of coal beneficiation. The impact of the agglomeration is a significant decrease in moisture content, an increase in heating value, a small decrease in ash content and almost 100% recovery of coal and bridging liquid and a decrease in moisture capacity.

The hot alkaline treatment of coal resulted in the conversion of clay minerals to various sodium hydroaluminosilicates and extraction of quartz. Hematite was found to be the solid conversion product of the pyrite. Extraction of the alkali leached coals

with HCl removed hematite, calcite and various sodiumhydro-aluminosilicates. Mineral matter remaining after the combined treatment consisted of mainly unreacted pyrite, illite and amorphous silica.

Demineralizing coal with chemicals will remove inherent mineral matter that is inaccessible by physical methods. Results have shown that ash levels can be reduced to $<0.5\%$ d.b.

Coal Petrography

Comparison of vitrinite reflectance and sporinite fluorescence in relation to coal properties showed that the vitrinite reflectance is more closely associated with volatile matter content than sporinite fluorescence; but sporinite fluorescence is more closely associated with calorific value and maximum fluidity than vitrinite reflectance in different coal ranks as well as in the same coal rank.

Separation and characterisation of macerals of Chinese coal showed that density gradient centrifugation provides a good separation into maceral fractions. The almost continuous variation in chemical and physical properties with density is remarkable.

Transmission electron microscopy (TEM) has been found to describe and quantify the microtexture of coals and cokes.

The influence of rank and maceral composition on combustion of pulverised coal showed that the coal rank has a larger influence on the overall combustion process than the maceral composition. Bituminous coals of higher ranks, especially those rich in inertinite, were found to have large combustion periods, to avoid high residual carbon levels in the fly ash.

The morphology of chars produced from Gondwana coals by pyrolysis, studied by microscopy could be classified into three types, viz. cenospheres, honeycomb and unfused. These arise from vitrinite, low-and high-reflectance inertinites respectively.

Petrographic composition influences both the liquefaction behaviour and the properties of the products. The presence or absence of cations and the pore size distribution in coal macerals contribute to the maceral dissolution and to the formation of carbonised residue.

The behaviour of coals in conversion processes could be related to total reflectance frequency distribution through reactive, semi-reactive and inert constituents. They correlate with the degree of conversion of coals in the case of hydrogenation.

To distinguish between inert and reactive macerals, it is not necessary to know what proportion of semifusinites are reactive. Knowing the $R_{0\text{ MAX}}$ of the vitrinites, the reactive cut-off can be calculated. The proportions of reactive and inertinite

macerals can then be measured from reflectogram. This will help in the coke strength predictions with a greater degree of accuracy.

Pyrolysis

Flash pyrolysis were found to be independent of reactor size and residence time and sub-bit coals have been converted into refinery feed-stock grade oils using red mud as a slurry phase catalyst and using fused beds of steelwool and nickel-molybdenum catalyst.

Rapid pyrolysis of coal showed that the apparent global activation energy increases with the rank of coal.

Catalytic hydropyrolysis of coal under fast heating conditions using a small fluid-bed reactor showed the feasibility of catalytically promoting the vapour phase hydrogenation of coal volatiles at atm pressure.

In the absence of externally added H_2 flash heating of a $Zn-Cl_2$ impregnated low rank bituminous coal was found to yield large amounts of tar products than the untreated sample. This is the reversal of the trend observed in slow pyrolysis. Flash pyrolysis of coal with reactive and non-reactive gases showed increasing yield of gaseous hydrocarbons.

Chars produced from flash pyrolysis of two subbituminous coals show high reactivity to oxygen, burning at rates upto 10 times than those for bituminous coal char and petroleum coke.

Pyrolysis at high heating rates need not necessarily yield high yields of liquids. Besides heating rate, pressure and gas atmosphere, particle size and temperature influence liquid yield. For the production of high liquid yields, it is necessary to combine high yields from primary thermal decomposition at high heating rates with optimum conditions for fast hydrogen access to the coal particles and the released volatiles at higher pressure and reaction temperature.

Chemically pretreated coals when carbonised could be used as a hard feedstock for the production of activated carbons.

The course of swelling of single vitrain and durain particles of different high volatile coals during pyrolysis and hydropyrolysis showed that from the measurements of the particle change new data can be created, on the basis of which the interplay of chemical reaction and mass transport at pyrolysis and hydropyrolysis can be discussed.

Instrumentation Techniques

Investigations of surface oxidation by Diffuse Reflectance Fourier Transform Infrared Spectroscopy (DFTIR) showed that oxidation occurs in conjunction with

moisture loss and results in the eventual loss of hydrogen bonding, aliphatic structure and the formation of anhydrides.

Measurement of the organic sulphur concentration in coal macerals using quantitative electron microscopic technique showed that it is most useful in measuring the organic sulphur content of small volume of coal and individual macerals.

High Resolution mass spectrometer has been used in analysing the high boiling liquid coal products.

Trace Elements

The association of 34 elements with minerals found in coal was determined by a combination of analytical techniques on low temperature ash.

Electron microscopy has been used to characterise the starting mineral matter in coal samples which were subsequently combusted in a laminar flow reactor.

Instrumental neutron activation analysis was used to determine the concentration of the elements and X-ray diffraction analysis and scanning electron microscopy were used to identify the minerals present in L T ash. Upto 73 elements were determined with high sensitivity and good precision. The techniques provide valuable data for characterising coal deposits and undertaking investigations into the environmental aspects of coal utilisation.

X-ray photoelectron and infrared spectroscopic study of the effect of oxidation on the fluid properties of coking coals showed that the fluidity inhibition is caused by a surface cross-linking reaction which occurs during the pyrolysis of oxidised coals.

The oxidation of coals were studied using PAS-FTIR (Photo-Acoustic Fourier Transform Infra-Red) and NMR spectroscopy.

Carbon-13 NMR spectroscopy with magic angle spinning was used to monitor the changes in low rank New Zealand coals as carbonisation proceeded, to obtain quantitative data on changes in the chemical constitution of coals and products with decomposition.

The molecular mobility of a range of Australian coals, during pyrolysis, has been studied by proton nuclear magnetic resonance thermal analysis. The results indicate that the thermoplasticity of bituminous coals is related to a transient molecular mobilisation of aromatic structures and can be described in terms of three partly overlapping processes.

Mineral matter transformation during combustion of a pulverised coal were studied using electron microscopy to determine the evolution of the starting mineral matter during the combustion process.

Natural Oxidation and Spontaneous Heating

The multi-technique approach is showing much promise in identifying specific changes during coal oxidation. Anhydrides have been found to be an early and significant oxidation product and marks one pathway of oxidative attacks. Oxidation occurs readily through a radical mechanism, leading to the emission of hydrocarbon gases and formation of anhydrides and carbonyl functionalities. A model, which considers simultaneous measurement of oxygen concentration and heat evolution has shown that such results from calculation and conclusions can give a better insight into the various mechanisms of oxidation.

Air drying of brown coal is found to decrease its reactivity towards oxygen and hence reduces the auto-ignition tendency. A model developed on the basis of laboratory measurements and a computerized one-dimensional mathematical model provides a good description of spontaneous heating, in a semi-quantitative manner.

Failure to specify the degree of weathering of coals used in research has introduced serious errors in process descriptions and interpretations. It is observed that a careful Free Swelling Index determination provides a rapid and reliable assessment of the weathering status of h.v.b. coals whereas slurry pH measurements provide a sensitive parameter for noncaking and sub-bituminous coals.

Determination of coal weathering by thermogravimetric analysis has shown that the maximum weight loss rate (H_{max}) can be taken as an indication of spontaneous heating susceptibility. It is found that H_{max} at mining, changes linearly with volatile matter; but that of each coal at the receipt side, is reduced.

The oxidation which occurs in a stockpile is not related to laboratory oxidation which occurs at temperatures higher than those found in the stockpiled coals. This difference could be due to the temperature dependance of competing reaction-pathways or due to the temperature dependance of a particular reaction change.

Observation of stockpile spontaneous fires, show that dehydration reaction first occurs, resulting in the disintegration of lumps, followed by the release of steam from inside the stockpiles. The passage of steam and airflow causes oxidation, hydrolysis and hydration reactions inside the stockpiles causing increase in the temperature from the heat of reactions, leading to partial distillation of low temperature combustible gases such as methane and ethane.

The oxidation of coals were studied using gas-desorption, activity measurements, PAS-FTIR (Photo Acoustic Fourier Transform Infra-Red) and NMR spectroscopy. Relaxation times obtained from the C_{13} NMR spectra of stockpiled coal indicated a loss of molecular mobility in the oxidised samples, consistent with the formation of cross-links.

On Inhibition

Coating of a coal derived tar on the surface of the carbonized coal, reduced the oxidation rate by the reduction of oxygen in volatile matter released by carbonization and plugging of the coal pores by the tar-coating.

The assessment and chemical inhibition of self heating in coal using a calorimeter which measures the total heat generated by coal under controlled oxidation conditions showed that chemical surfactants such as emulsified oils can inhibit the oxidation reaction. Under stockpiling conditions, the range of heating rates for safe coal, untreated and treated coals have been found to be 0.20-0.25, 0.88-1.30 and 0.46-0.56°C/day respectively. It is interesting that the treated coal was observed to stop heating, once the stockpile temperature reached approximately 60°C.

Combustion

Fluidised Combustion

Ash agglomeration conditions in a spouted bed coal gasifier, rate controlling mechanism in fluid bed combusters, mechanism of carbon attrition, fluidized bed combustion of low grade coals, combustion of coal-water mixtures in fluidized beds have all been presented.

Pulverised Coal Combustion

The combustion of pulverised bituminous coal has been studied, *in-situ*, using Fourier transform infra-red (FTIR) spectroscopy. This technique is an exceedingly useful technique for the *in-situ* measurement of gas phase combustion.

The overall oxidation of pulverised coal undergoing simultaneous devolatilisation and combustion is found to vary with oxygen concentration and particle size as well as ambient gas temperature. The measured rate is significantly higher than predictions using devolatilisation rate coefficients, and the sooty pyrolytic products consisting of tarry volatiles and microfractured particles are considered responsible for this apparent enhancement.

Pretreatment of coal, in reactive solvent with free radicals, produced improvement in two properties relating to bulk combustion characteristics. On the one hand, a several per cent reduction in the ignition delay at 1000°C occurred and volatile matter was increased from 0.6—0.5% on the other. These effects are directly linked to the presence of the free radical source in the pretreatments.

The combustion of pulverised lignite showed the presence of cations (specifically Ca, which is a catalyst for the carbon-oxygen reaction) enhanced the reactivity of Texas lignite.

Measurement of the size, temperature and velocity of burning particles has been used to determine the parameters which describe the overall particle burning rate per unit of external surface area.

Environmental

The mechanisms of NO_x formation and reduction during pulverised coal combustion shows that just after determination of volatile matter emission, the reduction rate of NO_x by char, surpasses the formation rate of NO_x .

NO emission levels in the exhaust gas could be reduced to 100 ppm by controlling the mixing of secondary air and primary fuel air jets to obtain a central reducing zone enveloped by an oxidising flame in which NO is produced.

Particulate control by electrostatic precipitation has also been discussed.

Recommendations/Conclusions Arrived at the Conference

It was agreed that research has to be carried out in a coordinated and integrated manner by the coal producing/processing countries for the speedy transfer of technology, commercially.

Coal liquefaction was suggested as the major thrust area followed by coal structure, beneficiation and combustion processes, keeping in mind the environmental aspects.

Major Breakthroughs or Results Reported at the Conference

Instrumentation analysis for coal seam discrimination using inorganic constituents, the sample preparation, quality-control of coal, oxidation kinetics, mechanism of coal liquefaction and new insights into the carbon skeletal structures are points of interest in the total processing of coal.

The solar dried coal slurry process evokes interest.

Simultaneous measurement of oxygen consumption and heat evolution from a coal gave interesting results to get insight into the mechanism of oxidation of coal. However, since the degree of oxidation of the sampled coal has an important role to play, the new liability index suggested by self, could go a long way in predicting the relative liability to spontaneous heating.

Combustion of coal-water mixture in fluidized bed achieved a carbon efficiency of 23% and boiler efficiency of 82% producing 30 kilowatt and can be used for residential and light industrial applications.

Possible Impact of the Conference on Indian Research Work

With increased mechanisation in the minds, though high rate of production is achieved, high and varying ash contents and thorough dissemination of the mineral matter poses problems in the processing industries. Furthermore, high heterogeneity of the coals obtained, necessitates a good sampling technique.

The planned production target of 350-400 million tonnes at the turn of the century with ash contents as high as 35% would contain about 130-140 million tonnes of ash in the mine coal. It would be a formidable problem not only to transport but also to wash such a huge amount of high ash coal with the conventional techniques to suit the requirements. The Indian cost data shows that to bring down the ash level from 23-17%, the cost goes up by $2\frac{1}{2}$ times, with higher ash coals, the cost would go up by about 4 times. This necessitates finding alternative routes which will be more efficient, comparatively more easy and economical.

Selective crushing to various sizes and proper blending, chemical comminution and beneficiation and oil agglomeration techniques have shown the possibility of beneficiation, but not found to be economically viable. However, the impact of the study on the petrographic constituents and corresponding selective crushing may perhaps make this technique useful in the petrographic beneficiation of coal, for use as high quality blend in coking-making.

Dry beneficiation technique based on microwave treatment and selective crushing, initiated at Kharagpur, may perhaps, be one of the possible approaches to the problem.

In the case of natural oxidation, leading to spontaneous heating of large stockpiles, spray of inhibitors (lime + $Na_2 SiO_3$ - 0.1-0.2% concentration) was found to reduce the oxidation.

The same rate of temperature rise was observed for the Australian and Indian coals (for the original and treated coals) with the use of emulsifying agents for Australian coals.

On the basis of a five year DST project studies on spontaneous heating in large scale coal stacks, conducted at Eastern Coalfields Limited, it is suggested that a spray of sodium silicate + lime at 0.1-0.2% concentration at the periphery upto 1m height and depth of the stockpile, with compaction, would help in the safe storage of coal, for a reasonably long period.

Flash pyrolysis, could be thought of, for the carbonization low rank and medium caking coals for getting enriched by-products.

Instrumentation analytical techniques must be utilised for a better understanding of the mechanism of coal carbonization, gasification, combustion and liquefaction.

More attention is to be given for the supply of uniform feed stock, particularly for developing the liquefaction technique based on the proven technology. Cheap and efficient Fe-based catalysts should be developed for such a purpose.

A total integrated approach based on the latest technology, right from coal beneficiation to the processing, should be attempted as a pool-up research concept, by the R&D organisations and teaching institutions, instead of the present piece-meal type of research work.

SHORT COMMUNICATIONS

PROFESSOR N APPAJI RAO, Department of Biochemistry, Indian Institute of Science, Bangalore participated in the FAOB SYMPOSIUM ENTITLED ENZYME MECHANISMS from December 3—6, 1985 at Honolulu, Hawaii, USA. The symposium had three major themes (a) Application of Mechanism Based Inactivators (Suicide Enzyme Inactivators) to Medical, Pharmacological and Biochemical Research; (b) Application of Affinity Probes to the Study of Enzyme Mechanisms; and (c) Hemostasis : Enzyme Mechanisms of a Heterogeneous System. In addition, 50 posters and 2 evening lectures were scheduled.

Professor Konrad Bloch, Nobel Laureate, a pioneer in the area, described his work on β -hydroxydecanoylthioester dehydrase. This enzyme is involved in the biosynthesis of unsaturated fatty acids. The substrate analog, 3-decynyl-S-pantathiene on hydrolysis yielded an intermediate which irreversibly inactivated the enzyme. In addition to the discussion of results, his lecture was sprinkled with anecdotes and illustrations of how these initial observations led to the opening of an entirely new area of research. He also indicated several criteria which need to be met before classifying a compound as a mechanism based inhibitor. R H Abeles discussed the role of transition states in enzyme mechanisms and inhibition of enzyme activity. The approach is to generate from a not so reactive substrate analogy, an unusually reactive intermediate which covalently modifies an enzyme active site amino acid. Compounds which form acyl enzyme intermediates which are very resistant to hydrolysis could also be used as inhibitors. The on and off rates from enzyme active sites were evaluated for several compounds and correlated with their ability to inhibit the enzyme. C H Walsh spoke on the inactivation of monooxygenases. This was probably the most significant presentation at the meeting. A Bhaduri described his elegant work on the rapid inactivation of glucose-4-epimerase during the catalytic process. Their results implicate the slippage of a UDP-keto hexose intermediate from an enzyme surface as a possible mechanism for enzyme inactivation. N Appaji Rao presented data which showed that mechanism based formation of the apoenzyme of serine hydroxymethyltransferase was responsible for the anti-tumor activity of D-cycloserine.

It was evident from the presentations made at this session that this area of research is progressing by leaps and bounds. The enzymes that appear most vulnerable to mechanism inhibitors appear to be lactamases, flavin oxido-reductases and oxygenases, proteases prostaglandin monooxygenases, etc.

In the second session application of affinity probes to complex macro-molecular systems was discussed. C R Cantor described the cross-linking of DNA dependent systems, while F Bucho presented data on the use of photoaffinity probes on ion channels. These studies were analogous in many ways to allosteric transitions in enzymes. R Wolfenden described clever studies on the use of transition state analogs as potential affinity labelling reagents. S Chen presented an interesting paper on the affinity labelling of the active site of pig liver NADPH-cytochrome b_5 reductase. After labelling, the active site with 5'-p-PSBA labelled peptide by tryptic digestion and reverse phase HPLC and showed these peptides were present at the NADH binding site of the enzyme. N Tagaya described the new type of affinity labelling reagents UDP-pyridoxal and adenosine polyphosphopyridoxal and showed that lysyl residues of glycogen synthetase and lactate dehydrogenase can be modified. The same authors using 4-fluoro-4-nitrophenylazide specifically photoaffinity labelled type B monoamine oxidase. The mechanism of action and active site design of rabbit intestinal glucosylase-maltase complex was probed using heat inactivation, kinetics and physiological methods by A N Radhakrishnan. L R Gibbons examined specific cleavage of heavy chains of Dyenein ATPase by uv irradiation in the presence of ATP and vanadate.

In the session on hemostasis, EW Davie discussed blood coagulation cascade and the cloning of blood coagulation factors. Using amino acid and nucleotide sequencing as well as genetic engineering methods, these workers have delineated the structure of the proteases involved in blood coagulation. This integrated approach has made it possible for them to conclude that the inner core containing the active site for protease is essentially invariant, with a large amount of homology with other serine proteases; while the outer core is different for each factor and probably confers the specificity of these molecules. N Aoki spoke on fibrinolysis-its interaction and regulation, while S Iwanaga compared the coagulation system in invertebrates with that present in higher mammals.

General Impressions

The symposium was well organized with adequate time for discussion of the work presented as well as related points during a combined session of discussion after each group of presentations. Recent advances in enzyme mechanism as well as the application of the information on the design of pharmacologically important compounds was discussed in depth. The work on blood coagulation factors and tissue plasminogen activators clearly point out the need for combining the genetic engineering methodology with protein sequencing and structure determination. Cloned proteins are often recognised as foreign by human system and therefore a careful study of the cloned, expressed and isolated proteins is important. Our country, on the threshold of a new era in biotechnology, would pay a heavy price for ignoring the need of integrate gene engineering with sophisticated enzymology and protein sequencing.

DK PV KULKARNI, Physical Research Laboratory, Ahmedabad-380009 participated in the IAU SYMPOSIUM NO. 118: INSTRUMENTATION AND RESEARCH PROGRAMS FOR SMALL TELESCOPES at Christchurch, New Zealand, from December 2-6 1985. The symposium was held at the Teacher's College, University of Canterbury, Christchurch, New Zealand. About 135 scientists attended the symposium. Eighteen review papers, and 80 contributed papers were presented. Out of the 80, 18 were selected for the oral presentation and 62 were presented as poster papers.

As the title of the symposium indicates emphasis was on use of small telescopes (upto 1.5 m diameter) with clever instrumentation and for problems which could be handled with small telescopes more conveniently than with the large (> 1.5 m diameter) telescopes. In the opening review talk a number of examples were sighted where small telescopes have made significant contributions in the past. After S Chandrasekhar pointed out in 1946 that light from hot stars should produce polarization the first results on stars and interstellar polarization came from the 1 m telescope of Naval Research Laboratory in 1949. Intrinsic circular polarization was soon reported by Campbell with a 86 cm telescope. Similarly optical polarization in Crab Pulsar 0532 was measured by the 90 cm telescope at Kitt Peak. Later, many observations on polarization of pulsars were made by small telescopes.

Eclipse of dwarf novae, white dwarf disc eruption in a binary, rapidly rotating A_p stars, rings of Uranus and many such phenomena have been studied by small telescopes.

Radial velocities of stars and following of γ ray bursts are another very interesting studies conducted at many places with small telescopes.

It was pointed out that the use of small telescope has advantage of efficiency, adequacy, availability, flexibility and over and above, serendipity.

With modern detectors the power of small telescope is very much increased. With a clever instrumentation a 1 m telescope can give performance equivalent to a 4 m telescope. Amongst the modern detectors CCD Cameras are at the top. The image intensifier and multichannel photometers are also extensively used. A number of papers discussed use of CCD chips. With a 1 m telescope and a CCD Camera objects of 17th magnitude could be easily studied. With this, red shift survey of galaxies could be undertaken. "Halo Star" survey also would be important. It was pointed out that out of the available GEC, RCA and the newly introduced Tektronix CCDs the last one is much superior. They were described as "next generation CCDs". They would be available in two sizes 13.8×13.8 mm and 55.3×55.3 mm, the later giving an area of 30.2 cm^2 . With small telescopes the later CCD would have a very large sky coverage (about $10 \text{ arc min} \times 10 \text{ arc min}$). This advantage would open up entirely

new fields of research such as study of very large extended objects, survey of galaxies, monitoring of globules, etc. The CCD chip also could be very conveniently used for spectroscopy. Of course back up electronics with powerful computers are needed to fully exploit the CCD capability. The Tektronix CCD is however, expensive. Such systems would cost between \$ 40,000 to \$ 80,000.

From Kitt Peak it was reported that their 0.9 m telescope with CCD camera is doing equivalent work to 5 m telescope. Photomultipliers are gradually being phased out there.

To reduce sky background a few astronomers reported the use of a mask on the star field where star light of desired stars is only allowed to fall through a pre-pierced plate placed at the focal plane. This technique has worked well on even a 16 inch diameter telescope.

With CCD, research programs of standards, faint stars, variable stars, faint galaxies, astrometry, etc. are very much worth taking.

There were only couple of papers presenting polarization studies. The delegate's paper presenting polarimetric *Study of Bok Globules with Small Telescopes* on 4 globules (B-361, B-5, L-1534 and L-134) was one of its kind and was very well received.

PROFESSOR RAM K VARMA, Physical Research Laboratory, Ahmedabad-380 009 participated in the INTERNATIONAL CONFERENCE ON MICROPHYSICAL REALITY AND QUANTUM FORMALISM (ICMR-QF) in Italy from September 25 to October 3, 1985. The conference (ICMR-QF) was organised to mark the 50th year of the Einstien-Podolsky-Rosen (EPR) 1935 paper which had sought to challenge the orthodox (Copenhagen) interpretation of quantum mechanics. The issues raised in the paper which were supposed to have been answered by Bohr, have recently been revived with the recent spurt of interest in the hidden variable theories following a paper by Bell (1964).

The highlight of the conference was a series of discussions involving the question whether or not nonlocality is forced on us by quantum mechanics as an element of microphysical reality and whether it is possible to save locality by constructing alternative theories using "hidden" parameters. Scientists who actively participated in these discussions included : T Brody (Mexico), H Stapp (Berkeley) N D Mermin (Cornell), Costa de Beauregard (Paris), J P Vigiér (Paris), T Angelidis (London), O Piccioci (La Jolla), T W Marshall (Manchester) and F Selleri (Bari).

The delegate (R K Varma) presented a paper on a derivation of a generalized Schrodinger formalism starting from a Hamiltonian flow in a configuration space

of one higher dimension. The generalised Schrodinger formalism includes the usual Schrodinger made as the $n=1$ mode of the generalized formalism. The other modes $n = 2, 3, \dots$ etc. thus predict the existence of additional, new modes of quantum behaviour. According to the Canadian mathematician, Professor Miller of the University of British Columbia, the paper represented the first ever derivation of Schrodinger formalism from a Hamiltonian flow in a higher dimension.

This conference was devoted to very important conceptual questions regarding the nature of quantum phenomena. The study of these questions is not being widely followed in our country at the present time. If the study of these questions is taken up seriously both theoretically and experimentally, it will be of great value and should lead in future to the consideration of fundamental questions by physicists in our country which is now sadly neglected in favour of more "practical" studies. But fundamental questions of today constitute the backbone of creative research of tomorrow on the frontiers. Unfortunately, the delegate was the lone Indian delegate to this important conference. Unless there is more Indian involvement and participation in these activities, we shall continue to lag behind in the study of such questions.

PROFESSOR R K RAI, Dean, School of Environmental Sciences, North Eastern Hill University, Shillong attended the I INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY held at the School of Geography, Manchester University, Manchester, UK from September 15-21, 1985. This conference was organized by the British Geomorphological Research Group, UK and several other related organizations. The proceedings were published in English and French. It was the first international conference of its kind in this field.

Nearly 600 delegates from about 65 countries of the world participated in the conference. Papers which explicitly focus upon land conservation, resource evaluation, geomorphological mapping, engineering geomorphology and remote sensing account for nearly 20 per cent of the total abstracts submitted for the conference. Furthermore, the imperative of geomorphological materials help to explain high frequency of abstracts concerned with mass movements and to some degree neotectonics.

Professor H Th Verstappen spoke on geomorphology, resources, environment and the developing world. He emphasized that applied geomorphology needs a thorough knowledge of geomorphological concepts and research methods (lab, field and aerospace). He also stressed the need for exact and functional data should be given, concisely and ready for the use. Expertise in the fringes of geomorphology and cooperation with other sciences is essential for developing environmental geomorphology. Close cooperation between geomorphologist, decision maker/planner and

construction engineer is essential for implementation of recommendations made and leads to integrated geomorphology.

Professor J Tricat spoke on geomorphology and development. He mentioned that Geomorphology through relationship with other sciences enables us to know and understand better our ecology environmental resources. Professor Tricart also stressed that the geomorphology must be correctly assessed for both development and management programmes.

Professor Victor R Baker delivered the lecture on a new global geomorphology. In his lectures, Baker highlighted the important features of the global geomorphology. The delegate (Dr R K Rai) presented his paper in poster session, Landforms and settlements—A case study of twelve sample basins, Meghalaya, India. There was few suggestions also. Evidences of rejuvenation of the Meghalaya Plateau, Deccan Foreland, India. The paper had developed a theory to indicate that the rejuvenation of the Deccan Foreland has taken place from Aravalli region in Rajasthan to Meghalaya Plateau in North East India. The rejuvenation of Deccan Foreland has been closely associated with the Himalayan orogeny. There was a general discussion in international collaboration on geomorphology. A working group for international collaboration in geomorphology was formed. The delegate has been nominated as member of the working group from India.

During 15 to 20 September several excursions were arranged in different parts of England. On 20 September, the delegate attended the full day excursion of Karst topography of Malham district. This is the finest glaciokarst area in Britain. During excursion karst topographic features were noticed in the area. The beautiful examples of underground drainage were noticed in the area.

In the meeting of the national delegates, the following recommendations were accepted.

- (a) A large national geomorphological organisation should be asked to organise the second international conference in 4-5 years. The date of 1989 was accepted.
- (b) An international committee should be set up to investigate and solve the problems associated with choosing the correct organisational form.
- (c) That an international newsletter be produced to report on matters of international interest. A formal invitation was given and accepted from the West German delegation.

The Second International Conference on Geomorphology will be held at Frankfurt, West Germany in September 1989.

Likely Impact of Conference on Indian Research

As already noted there is hardly any organised research activity in the area of geomorphology in India. However, it is desirable to initiate such research activity in view of the many applications of geomorphology in different socio-economic development and planning of an area. This conference has given an opportunity to the delegate to interact with some leading geomorphologist of the world, specially the geomorphologists of BGRG. There is a wealth of information in the proceedings of the conference for the research workers in India.

DR RAJAT K CHAUDHURI, Department of Botany, University of Calcutta, Calcutta, participated in the I INTERNATIONAL CONGRESS OF PLANT MOLECULAR BIOLOGY at Savannah, Georgia, USA from October 26 to November 2, 1985. The I International Congress of Plant Molecular Biology highlighted the significant contributions in plant biotechnology, particularly in transforming plant cells with desired genes for stress resistance, disease resistance, herbicide resistance, nitrogen-fixation etc., i.e. to grow plants in inhospitable conditions, and also evolving varieties with the aid of plant cell culture technique. The participants discussed different aspects of control mechanism of gene expression in plant cell nuclei, mitochondria and chloroplasts. Host-pathogen interaction is another topic which was discussed in length in this congress. Furthermore, the theme of the congress was highlighted in key-note addresses of Dr M S Swaminathan and Dr Barbara McClintock, NL, who were felicitated by the International Association of Plant Molecular Biology at the inaugural session of the congress. It is felt that many economically important crops of third world countries (like rice, jute, tea etc) were not adequately represented.

The delegate presented a paper entitled *Repetitive DNA Amplification during Organogenesis*. The presentation conveys the basic question of plant genome organization. It deals with the problem of organ differentiation and states that during the process an amplification of DNA sequences takes place. It is the middle repetitive fraction of a plant genome which varies from organ to organ and from plant to plant. On the other hand, the fast repetitive fraction of the same genome is conservative in nature, and its amount remains constant in different taxa. The exact nature of middle repetitive sequences and mechanism of gene amplification are yet to be ascertained. It is discussed in the congress whether some of them are transposon-like elements and whether they regulate functional genes. It is suggested that perhaps sequencing of such DNA sequences, after cloning into a vector, may reveal the true nature of middle repetitive DNA. Any tandem duplication of such sequences within a chromosome can be photographed by *in situ* hybridization.

Major breakthroughs of this international congress is that gene transfer can generate resistant varieties to herbicides. Other significant findings were (i) expression

of prokaryotic genes in plant cells, (ii) transposon mutagenesis and (iii) in vitro manipulation of nitrogen fixing genes. One of the conspicuous feature of this congress is that several biotechnology companies presented their findings and plans of work at different sessions.

Possible Impact of the Present Conference on Indian Research Work :

The International Congress of Plant Molecular Biology was attended by 3000 delegates and about 600 papers were discussed in 35 sessions, covering wide spectrum of plant molecular biology. This congress made central thrusts in uncovering new information on plant biotechnology, cell architecture, gene expression, mobile genetic elements, plant-microbe interaction etc. Each area is important to Indian economy, and findings therein are helpful in raising better types of plants and/or raising the crop yield. By felicitating Dr Swaminathan, the I International Congress of Plant Molecular Biology recognises the contribution of Indian science in the field of agriculture.

DR SHEELA ROY, Research Officer, Department of Pediatrics, AIIMS, New Delhi participated in the XII INTERNATIONAL CONGRESS OF ALLERGOLOGY AND CLINICAL IMMUNOLOGY at Washington D C from October 20-25, 1985. The Conference which is held once in three years, was organised by the International Association of Allergology and Clinical Immunology in Cooperation with the American College of Allergists and the American Academy of Allergy and Immunology. It was attended by over 1500 delegates from all over the world. Some of the topics of most general interest included clinical and basic aspects of IgE antibody, Immune complexes in allergic diseases, Advances in drug allergy, Asthma (recent understanding) Nasal allergy rhinitis, Atopic Dermatitis, Urticaria, Pollen allergy, Immunotherapy, Occupational asthma, Exercised induced asthma, Aspirin sensitive asthma, Asthma, treatment and prevention and many more other topics were discussed. Review of therapeutic modalities in Asthma was discussed in details. Treatment practices in Europe, USA and Japan were discussed by the individual authors of the respective countries. It was followed by panel discussion. In the prevention of asthma, role of viruses, vaccines, environmental controls and modern approaches were discussed and was followed by a panel discussion.

The delegate presented one paper in the poster session entitled *Nifedipine in Children with exercise-induced asthma*. The drug Nifedipine is a calcium channel blocker. Contraction of bronchial smooth muscle and release of mediators by the mast cells occur in Asthmatic attacks. These actions are calcium ion dependent. The calcium channel blocking agents inhibit or diminish the transmembrane penetration of calcium ions. As a result these agents can inhibit or reduce calcium dependent activities of the bronchial smooth muscles. It is now clear that EIA (exercise induced

asthma) is a direct result of heat loss from the airway and can be elicited. This entity was selected because it is short lived, easily elicited and can be controlled easily and is more common in children. Seventy five per cent of our children give positive history of EIA. 15 children were selected for the trial, 13 children showed increased exercise tolerance test with the drug from resting value while 10 control children who exercised without the medication, 90% of them showed poor performance which was shown by the poor pulmonary function test. Thus this drug seems to be effective in abating EIA. Criteria for the diagnosis of EIA include :

- a) History and/or documentation of asthma
- b) Use of bronchodilator for medication prior to exercise
- c) Positive history of exercised induced bronchospams
- d) Use of bronchodilators and
- e) Almost all resting pulmonary function values showed diminished value from the predicted value.

The drug seems to be effective, well-tolerated and no side effects were observed during the present study. Similar reports were also shown by other workers. On this occasion there were also a wide ranging and readily accessible technical exhibition so that all participants at the congress got the most out of what is always a potentially valuable practical encounter. Exhibitors were an important part of the educational opportunities at this meeting. A technical visit to NIH (National Institute of Health, Bethesda) and George Town Medical Centre were organised by congress which was very interesting and fruitful. This study will help to plan the efforts in this area. It was possible to formulate some ideas on immunoregulatory factors in the management and prevention of allergic diseases.

DR R BALASUBRAMANIAN, Assistant Professor, Centre for Energy Studies, Indian Institute of Technology, Delhi attended THE 1985 JOINT POWER GENERATION CONFERENCE held at Hyatt Regency Hotel, Milwaukee, Wisconsin, USA from October 20-24, 1985. This is one of the very major conferences organized by the Institute of Electrical and Electronics Engineers (IEEE), USA. The American Society of Mechanical Engineers and the American Society of Civil Engineers, covering all the aspects of power generation. The conference was inaugurated by Mr C R Whitney, Chairman & CED, Allen Bradley Co. and the key-note address was delivered by Mr Sol Burstein, Vice-Chairman of the Board, Wisconsin Electric Power Co. Session I was a Plenary Session on the theme Cogeneration Growth Worldwide with presentations by international representatives from Electric Power Research Institute (USA), FRG, Great Britain & Soviet Union. All the other sessions,

totalling to 48, were devoted for presentation of about 180 papers scheduled in 8 to 9 parallel sessions held simultaneously.

The delegate presented his paper entitled *A New Fourier Method for Evaluating Generation System Reliability Indices*. A new, robust and computationally efficient Fourier method was presented for evaluating the two commonly used reliability indices viz., the Loss of Load Probability (LOIP) and the expected value of energy not served, of a power generation system. An efficient algorithm has been developed for computing the outage probability density function of the generating units. The fast Fourier transform is then used for transforming the load duration curve and for inverse transformation of the product of the transformed outage function and the transformed load duration curve. As the method does not involve any approximation, unlike in the other existing methods it yields accurate results for any type of system.

This subject is of immense relevance and importance as the computer software developed by the delegate's group using the new method determines the minimum installed capacity requirement to ensure a specified reliability level of electrical Power Systems. This software package is of particular value in the Indian context as it is a computationally very efficient one and assesses the installed capacity requirement, which has to be done with great care especially in a developing country with limited financial resources.

DR RAKESH KUMAR (AIIMS, New Delhi) attended the I INTERNATIONAL-CONFERENCE ON ANTICANCER RESEARCH at Loutraki, Greece from October 26-30, 1985. The concept that cancer arises from somatic alterations in cellular genes was recently confirmed by the discovery of oncogenes, first identified in the genome of oncogenic retrovirus, which were subsequently shown of cellular origin and were incorporated into viral genomes. The role of the genes in the initiation of tumor formation was shown clearly by introducing *onc*-genes into transgenic mice, and the protein encoded by the sequences or the respective promotor-enhancer regions are active in different tissues. The transforming activity of *ras*-gene (which are of three types in mammalian genomes), responsible for oncogenic transformation is caused by a single point mutation involving the 12th and 61st aminoacid residue of the *ras*-protein (MW 21,000). The activation of *myc*-oncogene is caused by the alteration in the DNA region surrounding the gene, which in turn results in the loss of its ability to respond to external regulatory signals. Viral and cellular *myc*-genes if placed in the appropriate expression vectors, converts immortalized rat cells into anchorage independent and tumorigenic cells.

The primary translational product of Gardner-Rasheed feline sarcoma virus (GR-FeSV) is shown to consisted of helper virus coded P¹⁵ sequences, a portion of gamma actin and a tyrosine protein kinase, having aminoacid sequences similar to the product of *v-yes*, *v-src* gene (two distinct proto-oncogenes). The transforming gene

v-sis of SSV encodes a protein homologous to one of the chains of PDGF (which in turn stimulate autocrine growth) expression of which and *c-sis* RNA occurs at a very high frequency in spontaneous human tumors. Recently PDGF and EGF are also shown to induce the *c-myc* RNA level more than the basal level throughout the period of cell cycle which is a indicator of a similar postreceptor mechanism which converge proximal to *c-fos* and *c-myc* transcription, thus establishing their role in the neoplastic transformation.

The elevated levels of oncogene-related proteins in the urine of cancer patient are shown to be of diagnostic significance. In case of bladder and prostate cancer patient, the *3sis* related protein are elevated, in urine, in the absence of high levels of *ras* and *fes* proteins.

In the recent years, a large number of new anticancer agents are tried for their possible application in the control of cancer. Some of them are reported during this conference, i.e. vinca-23 oyl aminoacid derivatives, metallocene complexes, trans-1-diamono-cyclohexane, aclacinomycin A, ethionine, gallium chloride, C 18 fatty acids, new alkylating agents, aminoglutethimide, tumor necrosis factor (synthesis of which is increased by gamma interferon).

Another highlight of the conference include the reporting made in the area of new tumor markers and their application in diagnostic and follow-up-studies. Marker discussed were-carcinoembryonic antigen, alphafetoprotein, prostatic acid phosphatases, special low and high molecular weight proteins, serum alpha melanocytes stimulating hormone, water and lipid soluble sialic acid, serum alkaline DNAase, blood erythrocytes polyamines, tumor associated carbohydrate moities, intermediate filament protein (IFP) etc.,

Endogenous tumor cell surface lectins particularly galactose specific are shown to be involved in tumor cell aggregation, metastasis and in the expression of transformed and metastatic phenotypes.

Monoclonal antibodies are shown to have tremendous potential in developing effective treatment against cancer. Removal of malignant beta cells from bone marrow using particles charged with Mab particularly abrin immunotoxin.

Some of the general conclusions of the conference are :

- a) Various new drugs were recommended for their possible application in the combination therapy,
- b) Environmental and nutritional aspects of carcinogenesis were discussed and some preventive measures were suggested and
- c) Need for more research in the specific areas of cancer.

The First International Conference of Anticancer Conference was an unique scientific activity for various reasons. In this conference both basic and clinical oncologist from diversified areas of anticancer research, took part for common objectives of fighting against cancer. It gave an opportunity to exchange views on various critical problems the bottlenecks of anticancer research. This conference has surfaced lot of new information and progress made in various disciples of anticancer.

The result presented in the conference indicate that the result of present combination chemotherapy could be further improved, if recommended adjuvants and altered combinations are incorporated in the course of the cancer therapy.

The participation in the conference gave an opportunity to exhibit the Indian research work on the world arena. As the work presented was awarded and was selected as one of the ten best papers out of total of about 400 presentations. The winning of international award has further added to the reputation of Indian research in the area of oncology.

PROFESSOR ASOKE MOOKHERJEE, Department of Geology & Geophysics, Indian Institute of Technology, Kharagpur-721 302 participated in the INTERNATIONAL SEMINAR ON LATERITE at Tokyo, Japan from October 14-17, 1985 followed by field trip B-3. The conference, organized jointly by the Japan National Committee for IGCP, the Mining and Metallurgical Institute of Japan (MMIJ) on the occasion of centennial anniversary of the MMIJ, and the International Working Group on IGCP Project Proposal, had two principal objectives : presentation and discussion of technical papers, and formulation of a New Project Proposal for consideration of the IGCP. The technical session (Oct. 14-17) was preceded and followed by several field trips.

The second objective-formulation of a New Project Proposal had a crucial significance, since the three earlier proposals No. 214 (from India), No 213 (from France/Brazil) and No. 240 (integrated proposal from India, Brazil & France) were turned down by the IGCP.

Apart from contributing a paper entitled *Some Unusual Geochemical Feature of the Oxidized zone at the Central Sector of the Singhbhum Copper Belt, India* and participating in discussions on several technical papers, the delegate took active part in formulating the New Project Proposal to be submitted before the IGCP for consideration. In consultations with other participating Indian scientists, a letter was drafted and handed over to the organizing secretary, drawing the attention of the International Working Group to the fact that in a global project of such magnitude, the Indian National Science Academy must be involved. The suggestion was accepted by the International Working Group.

The plenary lecture by C R M Butt entitled *A basic for Geochemical Models for Tropical terrains, an account of Current research at CSIRO, Australia on Multi-element laterite Geochemistry for Detecting Concealed Mineral deposits* by R E Smith and *The roll of Cationic and Anionic Scavengers in Laterite* by R A Kuhnel were significant. The most interesting paper was by Leonardos, Fyfe & Konberg entitled *The use of Ground Rocks in Laterity systems : An Improvement in the use of Conventional soluble Fertilizer*, which evoked lot of discussions. The ideas presented there are worthwhile pursuing in this country.

Excursion to Hakeno volcano (No. B-3) was undertaken with a view to see active sulfatras and collect samples of 200 year old audesite lava flows.

PROFESSOR A K SREEKANTH, Department of Aeronautical Engineering, Indian Institute of Technology, Madras-600 036, participated in the AIAA III APPLIED AERODYNAMICS CONFERENCE at Clairon Hotel, Colorado Springs, Colorado, from October 14-16, 1985. There were 18 sessions spread over two and a half days. Except for three invited papers presented at sessions 4,8 and 12 respectively, the remaining were conducted in 3 parallel sessions on each day. The topics covered in these sessions were as follows : Vortex flows, unsteady aerodynamics, viscous aerodynamics, aerodynamics applied to the design of large aircraft, fighter aerodynamics, wing design and analysis, missile aerodynamics, grid generation, panel method, configuration aerodynamics propulsion aerodynamics. High angle of attach aerodynamics, rocket aerodynamics, aerodynamic testing and airfoil design and analysis. In all, a total number of 73 papers were presented in the above areas. There were two invited talks, one by R H Petersen and R P Harris on Applied Aerodynamics at NASA Langley Center and the other by W F Balhaus on Applied Aerodynamics at NASA Ames Center, giving a summary of comprehensive work done by each laboratory in the field of Applied Aerodynamics in the last 10 years.

The delegate presented a paper entitled *Symmetric Separated flow past Slender bodies at Angles of attack in Subsonic and Supersonic flows* was presented under the subject category *High Angle of Attach Aerodynamics*. Five papers were presented in this session out of which 3 came from foreign countries viz. France, Germany and India. The paper dealt with the development of a prediction method to determine the normal force and pitching moment on bodies of revolution along both in subsonic and supersonic flows at angles of attack upto the onset of asymmetric vortex shedding. (approximately of the order of about 20°). The presented analysis assumes that the contributions to the normal force and pitching moment can be thought of as comprising of two parts, viz. one due to inviscid flow and the other due to viscous effects. Woodward's these dimensional panel method was used for inviscid flow contribution. In the viscous analysis the contributions from the shed vortices and the feeding sheet were accounted separately. The strength of the feeding sheet was determined in an

iterative manner. The presented work was an extension of the works of Mendenhall and Nielsen of Nielsen Engineering Company and Oberkamps and Nicolaides of University of Notre Dame. The main highlight of the presented paper is the proposition of a model to calculate the strength of the feeding sheet and its effect on the force distribution. It was found that one cannot ignore the feeding sheet and take into account only the core vortices as was done by earlier workers. The feeding sheet contribution was quite significant.

In attending a conference of this type one could notice that particularly in USA, various groups are working in parallel on the same or similar problems with the result that there is a large forum for mutual discussion and interaction. This aspect is almost completely absent in India, where some of the important problems are tackled or looked into in isolation by a single individual worker. It is absolutely essential that we should encourage group activity in order to make any significant impact by our work. There should be much more collaboration between industries, R and D organisation and the concerned departments in universities than what is existing now.

The present conference highlighted once again the every increasing role of computers in aerodynamic analyses and design. Development of new analyses codes, updating of the existing codes, their validations, limitations etc. are being done extensively by various groups and there is a free flow of these programmes from the developer to the user. However, some of these sophisticated programmes such as Pan-Air, Missile Datcom etc. are not available outside USA. As such, there is an urgent need to develop these and similar programmes, in the field of aerodynamics, in India. Although some attempt has been made in this direction by the Aerodynamics Panel of the Aeronautics Research and Development Board by supporting projects; what is being done is not enough and a major thrust in this direction is necessary.

On-going development programmes in industries, based on the need of a country, serve as catalysts to identify new research areas and subsequent work on them. The absence of a major development programme in the area of aviation, either civil or military in the last few years has naturally resulted in a low level of research activity in the field of aeronautics in our country. It is hoped that the new envisaged programmes such as LCA etc. will spurt the aeronautical activity in the country.

Forthcoming Seminars/Symposia/Conferences etc.

IUPAC Sponsored International Symposium on New Sensors and Methods for Environmental Characterization at Kyoto, Japan from November 10-12, 1986.

IUBS Sponsored International Conference on Seed Production of Vegetables at Davis, USA in November 1986.

IUBS/SIL Sponsored XXIII International Limnological Congress at Hamilton, New Zealand from February 8-14, 1987.

IAHS/IUGG Sponsored International Conference on History of Hydrology at Rome, Italy from April 6-10, 1987.

IUPAC Sponsored CHEMRAWN VI : World Conference on Advanced Materials needed for Innovations : Energy, Transportation and Communications at Tokyo, Japan from May 17-22, 1987.

IUPAC Sponsored International Symposium on Macromolecules—Small Angle Scattering and Related Methods at Prague, Czechoslovakia from July 13-16, 1987.

XXXI IUPAC Congress at Sofia, Bulgaria from July 13-18, 1987.

IUPAC Sponsored XXV International Conference on Coordination Chemistry at Beijing, China from July 21-26, 1987.

IUBS Sponsored XIV International Botanical Congress at West Berlin from July 24 to August 1, 1987.

IUCr Sponsored International Symposium on Neutron Scattering at Lucas Heights, Australia from August 5-8, 1987.

International Science News & INSA Delegation Reports

Vol 4 No 4

October 1986

CONTENTS

		Page
Editor's Note	A N Mitra	iii
International Symposium on Grass Systematics and Evolution	S K Jain	1
II Indo-Soviet Conference on Low Temperature Physics	E S Raja Gopal	7
IUBS General Assembly	A K Sharma	11
International Symposium on Farming Systems, Research and Extension	S S Cheema	15
III Asian Pacific Symposium on Cardiac pacing and Electrophysiology	K K Sethi	20
V SABRAO International Congress	G M Reddy	23
II Congress of the Mediterranean Society of Therapy	T K Shanmugasundaram	27
II Organizational Meeting on IGCP Project on World-wide Comparison of Active Faults	K S Valdiya	31
1985 International Conference on Coal Science	V Mahadevan	34

Short Communications :

FAOB Symposium on Enzyme Mechanisms (N Appaji Rao); IAU Symposium No 118 : Instrumentation and Research Programs for small Telescopes (P V Kulkarni); International Conference on Microphysical Reality and Quantum Formalism (Ram K Varma); I International Conference on Geomorphology (R K Rai); I International Congress of Plant Molecular Biology (Rajat K Chaudhuri); XII International Congress of Allergology and Clinical Immunology (Sheela Roy); The 1985 Joint Power Generation Conference (R Balasubramanian); I International Conference on Anticancer Research (Rakesh Kumar); International Seminar on Laterite (Asoke Mookherjee); AIAA III Applied Aerodynamics Conference (A K Sreekanth).